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Fig. 14.

Fig. 14

Engraved by J.r Godby.

St. Pierre.

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HARMONIES OF NATURE,

BY

J. B. H. DE SAINT-PIERRE;

BEING

A SEQUEL

TO HIS

STUDIES OF NATURE.

59902

IN THREE VOLUMES.

WITH A PORTRAIT,

AND A

PREFATORY ACCOUNT OF THE AUTHOR, AND THE WORK.

By LOUIS AIMÉ-MARTIN.

——— Miseris succurrere disco. ÆN.

TRANSLATED

By W. MEESTON, A.M.

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INTRODUCTION,

BY

L. AIMÉ MARTIN,

EDITOR OF THE FRENCH ORIGINAL.

IF the sight of virtue struggling with adversity be entitled to our applause, the aspect of the sage who preserves unshaken tranquillity in the midst of civic discord, and maintains disinterestedness among the temptations of ambition, is still more calculated to excite our admiration. The former possesses that courage which resists personal hardships; the latter that moral strength which withstands the allurements of wealth, pleasure, and vanity, while it leads him to labour, without intermission, for the welfare of those who neglect and persecute him. He sees them contend for vain and perishable objects, while his mind is raised towards heaven and an everlasting life:—after dropping a tear of sympathy at the sight of their unprofitable efforts, he recalls his meditations to the search of immortal truths. Nature is his only study: the happiness of his fellow men his only

ambition; and that God, who surrounds him with his wondrous works, the object of his dearest hopes. It was thus when Athens was making vain attempts to bind nations to her yoke, when the Phocians were violating the temple of Delphi, when Dion fell under the assassin's poignard, and Philip, triumphing over the ruins of Olynthus, threatened the liberty of Greece, that the divine Plato continued to hold, along with his disciples, his tranquil station on the summit of Cape Sunium. There, under the shade of the wood of Minerva, and in the contemplation of those azure waves amidst which the towers of Delos were seen to rise, he forgot the crimes of men, and thought only of their virtues. Nature lay stretched before his eyes, and he called divine inspiration to aid him in the study of her works.

Such a spectacle might be deemed the fruit of a poet's imagination, had it not the concurrent testimony of antiquity, and had not the example been repeated, in our days, by a philosopher, who, in point of benevolence, may be called the Plato of France. It was in the midst of the calamities of Europe, in a season when ambition called forth wicked men, and when, unhappily, wicked men held sovereign sway in France, that the amiable author of the Studies of Nature, and of Paul and Virginia, fled from our affrighted cities, and took refuge in the bosom of rural solitude. He despised the honours earned by the sacrifice of virtue, and was indifferent to that fortune which deprives a man of friends, while it surrounds him with flatterers. He sought not

the applause of a factious crowd, but he received the benedictions of innocent victims at their dying moments, who had found in his pages an assurance of a future and a better life. Seated on the banks of a rivulet near his hermitage at Essonne, under the shade of the willow and the poplar, he was accustomed to say, "All is not yet lost; the orb of day continues to spread his bounty over our meadows, and to ripen our corn and our vines, as if mankind continued to be virtuous." He felt that many of the most conspicuous ornaments of the metropolis of France remind the spectator of little else than successful crimes; that palaces are scenes of meanness; and that triumphal arches are merely monuments of splendid trespasses. In the country, on the other hand, he found many objects that bespoke the power and majesty of God, along with the joy, the comfort, and affection of mankind. It is in scenes of nature that man learns to form a proper estimate both of the power and weakness of his mind. The stately animals, trained to obey his call, afford an evidence of his being the predestined lord of nature; while the vicissitudes attendant on his agricultural labours warn him not to trust too much to his own exertions; and finally, the confidence excited by the practice of devotion and of moral rectitude, teach him that God is an assured refuge in th hour of distress.

The belief of a future life contributes to add greatly to the interest we take in an aged person. On looking at his wrinkled features we are insensibly led to consider

him as approaching the reward of his well-spent days. Never was this expression more strongly excited than when my eyes were first fixed on the venerable author of the following pages. I had been conducted to his quiet retirement on the banks of the Oise, and approached it in a pleasant evening of autumn. All around me was calm, the moon shed her mild lustre through trees stripped by this time of their verdure, while a gentle murmur put the faded leaves in motion, and carried them to the adjacent meadow. I perceived on the slope of a hill the benevolent sage whom I had come to seek in this sequestered spot. Grey locks fell down his shoulders, virtue was marked in his features, and his blue eyes sent forth a look full of mildness. He seemed like one of the happy shades whom Virgil introduces in the midst of darkness under the pale foliage of the Elysian fields. It is impossible, siad I within myself, that so much knowledge and so much virtue can be destined to perish on quitting this transitory scene of existence.

It was in this retirement that the author of Paul and Virginia employed himself in the composition of the following work. He called forth his powers to display the bounty of Providence, at the ill-fated era when unprincipled demagogues were making an abuse of their official power by retrenching from the Latin poets the passages which recommended piety, that they might thus be rendered fit vehicles for an atheistical education. St. Pierre's steady adherence to the dictates of re-

ligion drew on him both the sarcasms and the ill-will of these superficial and evil minded men; but such was his amiable disposition, that he retorted only by continued efforts to enlighten and improve them. The disgusting scenes exhibited around him had no effect in lowering his estimate of his countrymen, or in enfeebling his exertions for ameliorating their lot. He knew no other feelings than those of sympathy and love, and the only change produced in his habits was a removal from active intercourse with society, and a more continued attention to the works of Nature. In the world, he said, wealth has usurped the station of honour, and power that of virtue; men prosecute pleasure, and meet only with remorse; but God never deceives us, and Nature never fails to afford consolation. His reflections, accordingly, never bear the mark of disappointment or bitterness. Buffon has been called the painter of Nature, but St. Pierre has a title to be accounted her most ardent admirer. He dwells on her charms with unceasing transport, and no one is more successful in inspiring others with a kindred feeling. Who can so well pourtray the impressions excited by the beauties of the dawn, the aspect of a verdant meadow, the solitude of a forest, or the fresh banks of a cheerful rivulet? His pages are full of life and eloquence, because he felt himself what he told to others:—like Armida, he may be said to have constructed an enchanted palace, in which the spectator forgets, for a season, the foibles, the passions, and the vexations of his species.

I shall now endeavour to give a slight sketch of the spirit and object of the following work.

PLAN OF THE HARMONIES, OR GENERAL SYSTEM, OF NATURE.

The sun is the primary mover and ruling power in the works of Nature: his presence confers life, and his absence is often the cause of death, in the animal as in the vegetable kingdom. On his removing to a distance from our hemisphere, the air ceases to be expanded, the water is no longer fluid, nor the earth productive: plants cease to vegetate, and many animals lose the power of motion. The world is deprived of its elastic spring, and covered with a veil of mourning; Nature seems to await a new call to life. But no sooner does the orb of day resume his influence, than the air becomes tranquil, the wave is stilled, and the sky refreshed by vapours.

Air is the next great agent in the works of Nature. Without air all is in danger of becoming extinct; even the solar rays do not produce heat. This is sufficiently apparent on the tops of those mountains, which, being of so great a height as to have a very rarefied atmosphere, are covered with perpetual frost. Our atmosphere may accordingly be called a kind of convex glass, with which the Creator has encircled the world for the purpose of collecting the rays of light. There is thus an evident harmony or connexion between the sun and our atmosphere.

Water may be called the third agent of Nature, and owes its fluidity to the operation of warmth. We see it in a variety of states, all of which are in harmony with the wants of man. The sea is fed by rivers; and rivers, on the other hand, derive from the sea a supply of water by means of clouds. The winds propel the clouds to the summits of mountains, where they are soon dissolved into water, and form streams which hold their circuitous course through distant regions. It is thus that, by a perpetual rotation, the same waters are always conducted to the same shores. The water in the stream running before our eyes is a part of the water which used to run before the eyes of our forefathers, and which will be seen to run, in a future age, by our posterity. The prodigality of Nature is only in appearance, for she is often economical when she appears to make the most lavish display.

The earth presents itself to our view under combinations still more varied, in consequence of its fossils, its valleys, its mountains, and its rocks. All its fertilizing powers proceed directly or indirectly from above; the sun may be called an inexhaustible reservoir for its flowers and fruits. These receive their taste, their perfume. and even their existence from his rays. A child, watched by his mother in his cradle, is not reared with greater care, or protected with more solicitude, than those seeds which appear to be thrown, as if by chance, on the surface of the globe. The sun seems appointed to convey warmth to vegetable products; the earth to

bear them, water to bedew them, the air to move and enliven them. Yet, after being the subject of all this care, they are evidently subordinate to another kingdom of Nature. Animals are doubtless of a higher class in the scale of creation, for they possess an instinct capable of receiving the images of objects, and a portion of discrimination, which, however limited, gives them, to a certain degree, the means of judging.

Man is the only created being to whom Providence has given the command of fire: he extracts it from the flint, from the trunk of the oak, and even from an accumulation of solar rays. He makes use of it to procure iron from the bowels of the earth, and the various applications of that metal and of fire may be regarded as the sceptre with which he advances to the conquest of the world. The possession of the vegetable kingdom enables him to engage in his service the most useful animals, such as the ox, the horse, the dog, the sheep, and to multiply them at will. He is even enabled to tame some of the sprightly tenants of the air, and to habituate them to assist him in the labours of the chase. No climate stops the civilizing progress of our species; it extends to the north and to the south, to the frozen and to the torrid zone.

Naturalists have not hitherto paid sufficient attention to the proportion which the extent of the products of the ground bear to the degree of labour bestowed on them. It may be laid down as a general rule that, even in the finest climates, the soil is bountiful only to

the extent to which it receives attention at our hands. A country neglected by man is soon abandoned by useful animals, and occupied by reptiles and poisonous insects. There are in Greece various districts in which the neglect of cultivation prevents those periodical visits of the feathered tribe which were common in the days of antiquity. The Island of Cyprus no longer sees those aërial wanderers light on her fields: like the friends who forsake us in misfortune, they fly a deserted shore, which offers nothing but the recollection of former enjoyment. The presence of man is thus indispensable to the beauty of nature; when he withdraws his aid, all falls back into primitive confusion. The cheerfulness of the fields is the fruit of his care; the brilliancy of the flowers the work of his hands. Until the cultivation of fruit-trees became an art, the peach was without sweetness, the olive was dry and harsh; the pear offered only a tasteless pulp, the apple was surrounded with thorns, and even corn was, in its early state, a small and meagre plant.* But when revolving ages had advanced the industry and ingenuity of man, the thorn was removed, the rose was made to increase in size and beauty, the peach and the pear became filled with a pleasant juice, the olive was freed from its bitterness, and corn became the great support of mankind.

But the greatest recommendation of the following work is its power in counteracting that tendency to in-

* See Buffon.

fidelity; which was one of the unhappy consequences of the French Revolution. The contemplation of the works of Nature invariably leads us to a consideration of the attributes of the Creator. This subject is so replete with dignified feelings that we cannot help being surprised that atheism should ever have had a teacher or a convert. These infatuated men attempt to make every thing subservient to their reasonings, and they are unwilling to acknowledge that a superior mind can have created the wonders around them. Their favourite arguments against the intervention of Providence lie in a reference to physical and moral evils; such as pestilence, tempests, volcanoes, and death. They have no pleasure in contemplating the beneficent part of the works of Nature; show them a flower, and they will point out the worm which consumes its bosom. It is by dwelling on scenes of waste that they seek to make us converts to their doctrine of annihilation; it is by making us bend under the pressure of the evils of life, that they expect to bring us to renounce the hope of eternity. To minds thus perverted, all that excites sorrow among mankind affords a ground of triumph; even when living in the country, they shut their eyes to the plentiful harvest that waves around them, to the beautiful sky over their heads, and to the beneficent effects of the orb of day. "Let us not lend an ear to those gloomy reasoners, who, while they are admitted to the enjoyment of so many blessings, refuse to trace them to their Divine Author. Their theories are contra-

dicted by the concurrent voice of every people; the most uncivilized nations are impressed with a belief of the existence of a Creator, and are accustomed to contemplate him in his works. Hardly had our world risen out of chaos, hardly had our ancestors been admitted to the enjoyment of light and life, when their thoughts were directed with gratitude to the throne of their Maker. Their mode of worship was in the beginning as simple as the nature that surrounded them; but the first application of their progress in art and science was to give dignity and splendour to their adoration. Temples were constructed with magnificence, and assembled tribes repeated there the hallowed verses taught to them by their fathers.

Men stand in all ages in need of consolation, and their best as well as their most natural refuge is in that Providence whom only the thoughtless or profane refuse to acknowledge. The era of the French Revolution was unhappily more remarkable than any other for attempts to circulate infidelity; but it likewise exhibited the most striking examples of the triumph of religious impressions. That which philosophy had presumed to stigmatize as a vain superstition proved the most effectual relief to the unhappy sufferers. When death came in prospect, theory was laid aside as futile and helpless; the suggestions of Nature alone were obeyed. The pretended philosopher might preach annihilation, when sitting at his ease and in the midst of worldly comforts; but the youthful victim mounted the scaffold under the

assurance of its being the path to a blessed futurity. In these dreadful scenes the attractions of beauty, wealth, and grandeur vanished like a dream; the thought of a beneficent Deity alone afforded consolation. This thought gave support in agony, and bestowed a heavenly treasure on those who had lost whatever is accounted a treasure on earth. Could we allow ourselves to be persuaded that there was no such thing as a future life, how many sorrows would remain without consolation?

To whatever quarter we turn our steps, whether we accompany a poet to the valleys of Arcadia and the banks of Arethusa, or a naturalist to the frozen regions of the north, we must lay our account to meet with the traces of misfortune. But the marks of comfort and pleasure are still more generally diffused; they are to be found in every department of the works of Nature. The murmur of the stream, the scent of flowers, and the display of their beautiful colouring, are all antidotes to the gloomy notions of those who dwell only on the unfavourable side of the picture. Spring comes forth, and all nature is revived and embellished; the valleys are covered with flowers, the slopes with verdure; the heavens recover their serenity, the sun his splendour; and gentle dews refresh the air. If from these splendid objects we turn our eyes to humble insects, we find many of them shine with the rich colours of the sapphire and ruby. Some of them may be seen skimming the waves, or hovering over the meadows; others, exercising various modes of industry in their lowly cells. Their numbers

remind us of an Arabian horde; their ingenuity makes us raise our thoughts with transport to the Creator of the Universe. A Mexican spider weaves, under a leaf, threads of gold, purple, and azure, the reflection of which resembles the colour of the rainbow. But it is in the care taken by Nature to preserve these little animals that her beneficence and foresight are particularly conspicuous. The wisdom of Pythagoras, and the genius of Plato, did not disdain to study the laws of these diminutive tribes; and even poetry found in them subjects of interesting description. Virgil passed from the exploits of heroes and the foundation of an empire, to the praise of the industrious bee; while in our own days we have seen in Germany two academies* direct their attention to the study of these insects. Their history is not like that of an insulated individual; it is the history of a tribe or community. It has happened, however, that the success of these associated academicians, provided as they were with letters patent to follow up their interrogatory of Nature, has been inferior to that of a blind philosopher living in seclusion; I mean M. Huber of Geneva, whose valuable treatise on bees is well known.

The more we examine the economy of insects, the greater will be our admiration of the arrangements of Nature. What can be more wondrous than the properties of a creature, who, by means of its little trunk,

* Those of Lusatia and Lauter.

sucks in the bosom of flowers a liquid which all the skill of chemists would seek in vain to extract? The bee has four little wings, while the ordinary fly has only two. Does not this prove that Nature has made provision to enable the bee to load its slender feet with wax and honey, by giving it the means of making its way through the air with this additional burden? Again, observe a solitary bee in the midst of a meadow; she settles on a flower, and endeavours to extract its honey; her efforts are unsuccessful, the depth of the calyx prevents her from penetrating to the spot which contains the treasure. She is not, however discouraged, nor is her harvest lost—like the American savages, who cut down a tree to obtain its fruit, she turns round the flower, saws its corol with dexterity, and removes the covering from the object of her search.

At no great distance from this you may fix your eyes on an industrious tribe, a little society, which seeks to exert all its labours for the common interest. Their foresight bears all the marks of sound reflection and ingenious combination. Turn your eye to the midst of their works, and you will perceive a collection of dark-looking insects employed in making long galleries, forming little cells, and rearing one stage of a building above another. Stop for a moment at the side of the cavern scooped out at the bottom of a tree, and you will see insects of a different class brought thither in captivity. The little prisoners fasten forthwith on the moistened roots of the plants, and extract from them a plentiful

supply of honey, which the masters of the mansion lose no time in gathering. These masters are ants; their assistant labourers are vine-fretters: the latter perform to the former a number of the functions of domestic animals.*

The number of insects scattered throughout the world exceeds all powers of calculation. They may be said to people the earth, the air, and the water; and to be, by means of their little saws, their pincers, and their graters, effectual co-operators in the destroying labours of time. They gnaw fruits, they annihilate crops, and they contribute to the overthrow of the aged trees of the forest. Nothing is impervious to them; they glide into the princely palace, consume the purple robe, and pierce the gilded wainscot.

Some persons are apt, on comparing the maternal care of Nature in regard to insects, to think that she has not sufficiently provided for man at his birth. To reason thus, however, is to give way to first impressions; for it is the long duration of our feeble state, the time required for our growth, and the hazards of various kinds attendant on it, that are the causes of our subsequent attainments. Were we provided with every thing from the moment of our birth; were we clothed by the hand of Nature; were our strength sufficient to keep us out of danger of every kind, there would be a stop to improvement, and we might look in vain for those inventions in art and science which are the boast of our

* See Huber's work on ants, and the excellent analyses of Pariset.

species. Our time would have been passed in idleness and languor; labour, with all its sweets, would have been unknown to us. It is thus that the strength of man originates in his weakness, his genius in his wants, his greatness in his humility. But after all our attainments we are frequently reminded of the frail tenure of life, and we should seek in vain to render our enjoyments complete. However enviable our situation, our mind continues to desire something beyond what it had formerly wished or figured to itself. We are thus strongly admonished that every thing is intended to be transient.

Such are the ideas inspired by the study of Nature, and which serve as a basis to the following work. It may be called a delineation, on a comprehensive scale, of the most remarkable phenomena in nature. St. Pierre was accustomed to compare himself to a pilot, suddenly cast among the waves on a slender skiff, and studying, by turns, the wonders of the ocean and the sky;—sketching at one time the summits of distant mountains, at another landing on a barren shoal or on the margin of an enchanted island. Sometimes, after the rage of a tempest, a beautiful prospect comes before his eyes; he makes there a temporary stop, and recovers from previous fatigue; but he soon finds himself called to prosecute his voyage, and while he makes use of soundings to ascertain his course through the waters, he raises his eyes to that heaven which guides him in his way, and is destined to be his eventual port.

St. Pierre's first plan was to follow the course of the

seasons, and to divide his book into twelve parts, under the heads of the respective months. He proposed to explain the harmonies of the sun with the air, water, and earth, in each of these respective periods. When treating of human harmonies, his intention was to illustrate the principles of public and private education, the means of controlling passion in youth, and the happiness arising from the gratification of our social affections. The portion of his work appropriated to topics of natural history was intended to explain various phenomena, and particularly the relations between the animal and vegetable kingdoms. He meant to enlarge on the connexion which may be traced between light and the eyes of animals; between the air and our organs of breathing; between night and sleep; between a warm covering and the climate in which the animals, thus equipped by the hand of Nature, are placed. It entered likewise into his views to give an historical sketch of the progressive changes in the treatment of the fair sex; and to show the tendency of civilization to ameliorate their lot. Each division of his book was to be terminated by a dialogue, calculated to illustrate the moral truths arising from the previous reasoning. Some idea of these projected dialogues may be formed by that which is subjoined to the present work. This plan was, no doubt, too extensive for the powers of an individual. Its grand characteristic consisted in departing from the ordinary course, and in taking, as a model, Nature, which circumscribes the individual, while she gives an

almost indefinite extension to the operation of general laws. St. Pierre used to observe that men were wrong in saying that time passed; it is we who pass, while time remains. Days, months, years, and ages, are to be considered as only so many modifications of time. All the laws of Nature are linked together; the setting of the sun in our horizon forms the dawn in another hemisphere; the end of one science is but the beginning of another; so that it would be in vain to think of studying the works of Nature effectually, without attending to them on an extensive scale.

In undertaking to act the part of editor on the present occasion, I was actuated less by a confidence in my competency to the task than by a warm admiration of the author. From my earliest youth I have occupied my thoughts with his works, and I have owed to them the most pleasant hours of my life. They seemed to me to cast additional charms over the beauties of Nature, and to excite a decided predilection to a country life. When in my subsequent progress I was exposed to sufferings of various kinds, I found a most satisfactory consolation in the religious effusions of this amiable man. He taught me to forget, along with himself, the injustice of others, the inconstancy of fortune, and the hardships of an unquiet career. When crossed in my most tender attachments, and disappointed in the sanguine expectations of youth, I found a refuge, with his works in my hand, in the bosom of Nature. They seemed to say to me: "The feelings which have hitherto actuated you have

been vain and delusive; but the emotions suggested by the aspect of Nature will never deceive you. Look at the tranquillity of this retreat; observe these marks of the bounty of Providence, and you will no longer give way to desponding impressions, or foster the gloomy notion that you are predestined to misfortune."

Having experienced so much comfort from the labours of St. Pierre, I felt that any attention on my part to the publication of his last work was but an act of gratitude. My exertions on the present occasion are accordingly to be considered a homage to his memory, in the same way as my former feelings were a homage to his talents.

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HARMONIES OF NATURE.

BOOK I.

GENERAL SKETCH OF THE HARMONIES OF NATURE.

THE Author of Nature rendered in the beginning all elementary powers subordinate to that of the vegetable kingdom. He said to the earth, clothed in the simple dress of uncultivated nature, "Produce plants with their fruits, each according to its kind;" and organized bodies proceeded from the words of the Almighty. The plains became covered with waving grass, the mountains with majestic forests; the slender willows and the tapering poplars bordered the banks of rivers, and formed a shade all the way to their influx into the ocean. The sea even had her vegetables; her weeds were suspended, like garlands, on the side of rocks, while *fuci*, similar to lengthened cables, rose from the bottom of the abyss, and sported in the azure waves. Cedars and firs surrounded with their solemn verdure the region of snows, and shook their

summits around those glaciers which approach the poles. Each vegetable had its temperature; from the moss, which, existing only by the reflection of the solar rays, covers the rocks of the north, and affords a warm couch to the Lapland rein-deer; to the palm, which, defying the heats of the torrid zone, affords a shade and refreshing fruit to the Arab and his camel: every spot had its vegetable, every animal its food, and every man his possession.

What a pleasant sight to observe, in an island not yet inhabited and displaying a virgin soil, a succession of those plants which Nature has deposited there in conformity to the primitive state of the earth! Never did shepherdess assort with so much taste the flowers she wears on her head, or in her bosom, as Nature has displayed in grouping the endless varieties of the vegetable kingdom, from the border of the sea to the summit of the mountains, to satisfy the wants of mankind and of the animals who are destined to derive from them support and gratification.

How great would be our delight, could we take into a collective view the range of vegetables which cover the earth, so as to discriminate the harmonies which prevail under each climate, and are apparent under every meridian! If, however, it is not given to us to travel throughout the

surface of the earth, it may be said that the earth performs, in some measure, the journey for us, by her annual revolution round the sun. After having put us under a freezing climate, she transports us by degrees into a temperate one; and, subsequently, into that which approaches to the torrid zone, offering us successively the plants of her winter and her summer growth. In this regular progress she turns toward the sun her northern pole covered with ice, to an extent of several thousand miles; and proceeds to lose, under the equator, the equilibrium of her two hemispheres. She next removes to a distance the opposite pole, relieved by this time of a portion of its frozen mass by the summer heats. Our hemisphere now receives heat through its whole circumference; and the immense masses of snow which covered Europe, Siberia, the vast plains of Tartary, the rugged mountains of Kamtschatka, and the gloomy forests of North America, are dissolved and carried to the ocean. Greenland, Spitzbergen, and Nova Zembla, behold the orb of light turning around their horizon without interruption; while streams, of a depth and width resembling seas, are discharged from the straits in frozen latitudes, and bear, in their sonorous course to the ocean, islands of ice, lofty as mountains, and numerous as the clusters

of an Archipelago. These immense masses are said sometimes to strike the bottom of the sea, at the depth of a thousand feet; but whether they remain stationary, or are carried along the current, they sink eventually into the surrounding fluid. Cataracts are observed to fall from the summit of these masses, and fogs to arise from their sides. The winds transport, throughout the atmosphere, their half-frozen vapours, and warm them in the solar ray; carrying them into the heart of continents, and shrouding with them the tops of the mountains which attract them. Some afford a supply to the sources of rivers; while others, suspended over extensive plains, are saturated by the heat of the sun, and send forth thunder and lightning. It is then that fertilizing showers cover the ground, that the corn forms its ear, and receives from above that supply of moisture, which during winter it extracted only from the earth by means of its roots. The rising flowers, interwoven with surprising delicacy, burst that soft covering which had protected them from the shock of winds and the biting frosts. The purple bud of the vine and the downy bud of the apple become swelled and burst: the reddened branches of trees are spotted with marks of verdure and with flower-buds of white and crimson. Vegetation in its cradle un-

folds its infant covering, and displays its smiling countenance around. Perfumes arise from the bosom of the meadows and forests along with the melody of birds; and vegetable life appears to descend from heaven.

I address myself to thee, Goddess of Affection, who, with a smile, didst create the spring; who risest from the bosom of the flood, surrounded by Zephyrs and playful Cupids. Poets and painters represent thee, as preceding, on our horizon, the car of the Sun, whose fiery coursers they have fabled to be led by the "winged "Hours." But, when thou appearest on the equator, on the horizon of our pole, thou art the source of day-spring in every direction. The morning comes forth from thy ruddy covering, clothed with the pearls of the east, and decked in many coloured robes; her beauty is conspicuous on the summit of rocks, on the surface of lakes, amid the reeds, beside the stream, and throughout the glades of the forest. May thy gentle influence guide me throughout the task which I have undertaken; consoling me for the remembrance of the past, the hardships of the present, and the anxiety for the future. My head is now covered with the marks of sixty-three winters; but by thy benignant power my imagination may revert to the happy moments of

youth, when the beauty of nature formed to my mind a delightful contrast with the arbitrary and selfish conduct of man. Afford me thy guidance through the valley of darkness, and through fields which derive their fertility and attraction from thee: my wish is to recall ungrateful men to the path of happiness, from which they have strayed, and to lay it open to their innocent progeny. My endeavour shall be to exhibit the beneficence of the Deity in the works of creation; my lessons will have nothing gloomy or obscure; my school is in the midst of meadows, woods, and orchards; and my books consist of fruits and flowers.

It has often caused me surprise, that we should be disposed to contemplate with so much indifference the vault of heaven, the source of our present enjoyments, and the object of our eventual hopes. We should be delighted to be admitted to a comprehensive view of that vegetable world which covers the surface of the earth; and we look with comparative coldness on the starry expanse which rolls over our heads. While so much pains and labour have been bestowed to display the properties of plants, we discover nothing in the celestial bodies, except globes governed by the laws of attraction. Feeble and vain as we are, we do not hesitate to confine

within a single idea that which we take in with a single glance; and we venture to lay down a system for the universe on a partial and superficial survey. The simple mosses, when analyzed, disclose a harmony calculated to direct our minds, with admiration, to that Being who superintends the destiny of the world; while our systems of astronomy are comparatively cold and uninteresting: yet, it is for the purpose of appropriating the advantages arising from the operation of the sun on the vegetable world, that we cultivate the ground and navigate the ocean. It is, consequently, the more extraordinary that, after all our labour and experience, after all the wants which are supplied from this source, we are still very deficient in our knowledge of the economy of the vegetable world. We may be excused in some measure for our ignorance of the celestial bodies; their relations with us, whether in rising or setting, in transient appearances, or in eclipses, being so inconsiderable as to furnish very limited matter for reflection. Were we learned as Copernicus, Newton, or Herschel, we could hardly boast of knowing more of these bodies, than the humble beggar knows of the stately lord, who, in travelling along the road, throws to him a charitable pittance, without disclosing his name or situation. Let us, therefore,

commence our reasoning from objects within our reach; and aim at extending our knowledge of the beneficent influence of the sun, by studying those vegetable powers which are the channel of his bounty to us.

Nothing can be more delightful, than the surprising number of plants, scattered, as if by chance, throughout our meadows and forests. No doubt there prevail in this seeming confusion laws of regular arrangement; but the difficulty lies in tracing and explaining them. We may, perhaps, be enabled to make some progress in this, by directing our attention to the two extreme points, it being evident that solar influence is the primary cause of vegetation, and the supply of man its ultimate object. Man alone, of all living beings, finds the means of turning to his use every latitude, every situation, every vegetable, and every animal. In considering, therefore, the kingdoms of nature as forming an harmonic sphere, the sun may be called the circumference, and man the centre; because it is towards him that the rays converge from all directions. In pursuance of this idea, I shall begin by considering man, when situated directly under the influence of the sun, and placed in that warm atmosphere, where we know from Scripture as we should suppose from philosophy, that he first

drew breath; because there the supply of his wants is produced with less toil, and in greater abundance than in other climates.

On analyzing the human constitution, we find it composed of various substances and humours, requiring incessant supplies; such as nerves, bones, veins, blood, and other fluids; to the constitution of which we are in general apt to pay very little attention. Nature has provided, as a daily supply, nourishment of a kindred character, such as corn, wine, sugar, oil; and has added a variety of other plants for the accommodation of man in regard to clothing and lodging: among the latter may be enumerated the various species of the palm-tree; the cotton-tree, so well calculated to afford a light covering; the bamboo, with its flexible shoots; the calabash, the fruit of which so easily takes the form of various kinds of vases. The plantain alone might have proved sufficient to supply the wants of man in a primitive state, for it produces the most healthful food in its mealy and saccharine fruits. No plant deserves so well the name of Adam's fig-tree, its fruit being evidently intended for human consumption; one of its clusters forms no inconsiderable load for a man, while its spreading top presents a magnificent shade, and its long green leaves may be easily adapted as temporary

clothing. It is under this delightful shade, and by means of fruits perpetually renewed, that the Hindoo Brahmin leads a life of tranquillity, and, deriving a supply for all his wants from one of those trees situated on the margin of a brook, is said frequently to attain the age of a hundred years.

But, whether the plantain was destined only for a particular situation, or whether, as is more probable, nature, in her beneficence, preferred supplying man with the greatest variety of aliment, certain it is, that the trees of the torrid zone bear delicious fruits of innumerable descriptions. A farinaceous or mealy substance is found to form the basis of most of those fruits, whether we look to those which may be directly converted to bread, or to fruits of an oily character, like cocoa. This substance is found in a number of roots, such as yams, cassada, Spanish potatoes, (*convolvulus battata,*) and even on the trunks of certain trees, as the sago; in the seeds of a variety of plants, such as the leguminous; and, above all, in the *gramina*, as rice, maize, corn, &c. This substance is seasoned sometimes with sugar, sometimes with wine, or oil, and its taste is improved in every particular species of fruit by an aromatic flavour peculiar to the species, and characteristic of it. Another observation of

importance is, that we are enabled to extract, by the process of fermentation, from this mealy substance a portion of the primitive savour deposited there by Nature, whether saccharine, acid, or even oily, as is exemplified in the familiar instance of brewing from barley. The ease with which our stomach decomposes this substance suggests the notion, that it has particular analogies with our solids and fluids, since it is so generally diffused throughout the vegetable world.

The wants of man are found to vary according to the latitude which he inhabits. Place him in the temperate zone, and you see rising around him corn and leguminous plants of various kinds; chesnuts, vines, apple-trees, olives, walnuts, &c.; while, as a protection from the severity of the elements, flax and hemp grow in abundance, and oaks or beech trees present their trunks and branches to the axe of the carpenter. If we proceed to the frozen zone, where vegetation seems about to expire, we shall see wild oats border the rivers of North America, while moss and mushrooms cover the rocks of Finland and Lapland. Forests of resinous fir and birch supply him with the means of protection against the snow, and enable him to dress his victuals on a humble hearth. Nature comes farther to his relief, by presenting him in abundance with

beasts of the chase clothed in thick furs, and with an incalculable store of fish; but her richest gift is the rein-deer, which supplies him with milk like a cow, with a fleecy covering like a sheep, and with the means of travelling like a horse.

The same beneficent provision that Nature has made for man, may be traced in her arrangements for other animals. Each in its kind, whether quadruped, bird, reptile, or fish, is found to have a particular species of vegetable provided for its supply. Man may be said to possess the best of each description, such as the corn among the gramina, the date-tree among the palms, and that long list of vegetables which are cultivated by his industry, and are consequently known as domestic plants. It follows from the vast range of supply provided by Nature for various animals, that a multitude of useful vegetables are still unknown to us. Nay, the farther we carry our researches, the more we shall be convinced that we are still at a distance from the discovery of appropriate vegetables for the supply of a number of our wants. In Europe, each generation has discovered and adopted some new plants; but many of them must be said to be merely relative in their use. By this I mean that we are obliged to import a number of them from a distance; such as tea, from China; coffee, from Arabia; sugar,

from the West Indies; cocoa and vanilla, from Mexico; tobacco, from North America. There seems little doubt that we may succeed in discovering a number of additional plants in our own climates. Why should not the inhabitants of the north of Europe be enabled to discover, amid all the varieties of their pine-trees, a species of which the kernels might be made applicable to the purpose of food? There seems in this no greater difficulty than in adapting to use so bitter and unpromising a fruit as coffee or olives.

After observing the connexion of the vegetable world with man and animals, let us proceed to consider its relations to the sun, agreeably to the nature of different latitudes. One of the most remarkable of these is to be traced in the flowers of plants which have reflectors or petals, for the purpose of casting the solar rays on the sexual parts, and thus accelerating their growth. These parts, in cold climates, are generally sheltered by ears, or small perpendicular cones, which receive the rays of the sun from his rising to his setting, and imbibe his heat during the whole summer, reflecting it in return on the *anthers*, *stigmata*, and *germen* of the flower. In temperate zones, the reflectors or petals are, in general, horizontal, so that they do not reflect the rays of the sun, unless when he is elevated above the horizon, and

only during a few days; but their reflection is more or less concentrated according to the situation which they occupy; as in the case of the radiate plants, which resemble plane mirrors; of the rose-shaped plants, in spherical segments; and the lily tribe, in elliptic forms. The arrangement of their flowers is governed by similar rules, some of them growing in clusters, some in a spherical, others in a hemispherical shape. In the torrid zone, the flowers with large petals are comparatively few in number, and bud only when under the shade of the branches which bear them; or they are found to have a diverging growth, as in the case of the Peruvian monkshood. Sometimes they are of the butterfly form, having on the sexual parts a covering like a keel; and this class, which produces leguminous grain, is found to contain a great variety of species. The ears of gramina are subdivided into a number of smaller diverging ears, so as to be very slightly reflected; this is the case with rice, while maize, on the other hand, is covered by several pellicles. Lastly, the direction of the growth of the most common trees in the frozen and torrid zones, appears subjected to rules appropriate to their respective destinations; the firs of the former being perpendicular and tapering like their cones, which they expose to every aspect of the sun; while the

palm-trees of the latter have expanded tops, calculated to temper the heat, and to diffuse a shade over the fruit, which hangs from them in clusters.

Thus does Nature employ different shades of colouring to increase or weaken the reverberating operation of the petals, according to situation, climate, and season; so that many vegetables, properly belonging to the north or south, may be produced in the temperate latitudes, and even in a climate materially different from its native one. However, we shall enlarge no more on this department of our subject, having treated at sufficient length of solar influence in the "Studies of Nature."

As the shape and colours of the flowers of vegetables are in harmony with the sun, and owe their growth to his rays, I am inclined to think that their fruits, and even their stalks, are indebted to him for attaining that condition which places them in harmonic connexion with the various wants of man and of animals. The annual revolution of the earth round the sun adds regularly a ring to the trunks of certain trees, and his rays affix a white, a yellow, an orange, a red, a purple, or a blue colour to their flowers, according to their particular species. Why, therefore, should not the solar rays be the primary cause of infusing an acid, a saccharine, an oily, or an aro-

matic taste into those fruits of which the flowers are only the fore-runners? Every vegetable has, no doubt, a determinate character, reproduced by the sexes, and fixed in an invariable manner by the Author of Nature; but it seems nowise unlikely that these sexual marks are only agents for the operation of the solar influence. In truth, plants appear to possess more of a solar than of a terrestrial character, their taste being much more strongly marked in the torrid than in the other zones. It is in that part of the world that we find the plants containing the most powerful acids, oils, perfumes, spices, and sugars. Moreover, the qualities of most plants are so transient, as to disappear entirely on their decomposition; and a chemical analysis affords little else than a *caput mortuum*, whether we apply it to noxious or to useful vegetables. This truth has been exemplified by the learned Homberg, in a course of experiments made on nearly a thousand of our vegetables; and my inference is, that their respective qualities, so varied and so active while they remain in existence, are merely emanations from the sun, and fugitive like that life which they owe to him.

It is proper to remark, that the vegetable kingdom is combined in various ways with the other kingdoms of nature. By way of affording some

idea of their various relations, we shall endeavour to exhibit them in a comprehensive sketch; entering subsequently into more particular details, and concluding by showing the application of all these various objects to the wants of man; a task which forms the grand subject of our inquiries.

The vegetable kingdom presents, like the other departments of Nature, what may be called thirteen harmonical relations: the first is celestial or soli-lunar; six are physical; and six moral. I use the name of soli-lunar, because the moon here exercises an influence in conjunction with the sun. Of the six physical harmonies, three may be called elementary, viz. the aerial, the aquatic, and the terrestrial; while three may be called organized, namely, the vegetable, the animal, and the human. In the moral harmonies, we find likewise three that are elementary, the fraternal, the conjugal, and the maternal; while three are organized or social, viz. the specific, the generic, and the spheric.

These harmonies are marked by a progression in point of power, the second combining and augmenting the faculties of the first; the third, in like manner, those of the second, and so on till we arrive at the spherical; which is not only composed of the various faculties of species and genera, but has, by its revolution, an incessant

tendency towards infinity. These harmonies have long been so clearly established, that our various botanical systems are founded on the distinctions arising from them; and where these systems are imperfect, the deficiency will be found to arise from their authors not having sufficiently embraced the distinctions in question. However extensive may be the harmonic order, we are hopeful of conveying a clear idea of it, by fixing, in the first place, the attention of our readers on the plant which produces corn, as the most easily comprehended in consequence of the simplicity of its shape. We shall consider it as the first of the genus of *gramina*, the species of which are so numerous, and as, without contradiction, the most important of all plants to the support of mankind. Moreover, why should we, when in quest of proofs of the agency of Providence, go to the cedars of the north, or the palm-trees of the torrid zone, when so beautiful an exemplification of the order of the universe lies at our feet, and may be subjected to demonstration in a stalk of wheat?

Corn is placed in what I term a harmonic relation to the sun, by the lower part of its stalk, which receives heat on all its circumference by means of small leaves, which are linear and slighty concave, so as to reflect the rays to the centre. It is placed likewise in that relation by the reflec-

tion of the ground around its base, which transmits to it a portion of that heat which itself receives. One of the advantages of a humble over an elevated situation, is the enjoyment of the lesser favours of the elements, and a shelter from their revolutions; as is shown in the familiar instance of grass growing more quickly than shrubs. Corn has a farther connexion with the sun by the upper part of its stalk, covered with an ear that is moveable, and of several aspects; its perpendicular attitude enabling it to receive the solar rays from dawn till sun-set. The reflection of the heat is here so sensible, that, on observing a ripe field with a full exposure to the south, we are apt to imagine that a kind of flame arises from it, and that the ears produce a luminous effect. We may trace likewise lunar harmonies in the knots which separate the straw from the corn, and which are equal, in point of number, to the lunar months during which the growth has been going on until the formation of the ear; but we reserve this part of our subject until we come to treat, (under the harmony of genera,) of the relation of vegetables with the moon.

Corn maintains an harmonic relation with the atmosphere, by means of its tracheæ, which are, in fact, the lungs of plants; by means of its linear and horizontal leaves, which afford no hold

to the winds; as well as by means of its elastic and hollow stalk, strengthened by a greater proportion of knots towards the root, where support is necessary, than towards the ear. Each of these knots is farther strengthened by a leaf, the lower part of which serves as a kind of sheath to the knot. By means of these nice arrangements, the stalk plays incessantly with the winds, which make it describe beautiful curves, while it is found capable of withstanding the rage of those storms which overthrow the stubborn oaks of the forest.

The aquatic harmonies of corn are displayed in its leaves, which convey rain-water to its roots, while the latter suck the moisture of the ground, the vapours of which produce dews. In climates where rain seldom occurs, the latter method of absorption is found sufficient for the nutrition of the plant; as is the case in Egypt, where redundant harvests are produced on a soil seldom refreshed by showers, and indebted almost solely to the overflowings of the Nile. I have personally witnessed striking examples of the power of dew in the neighbourhood of Paris, where the soil is almost always deficient in moisture. I remember a summer so dry as to have no rain throughout March, April, or May; the corn crop, notwithstanding, was by no means indifferent, the grain being well filled though the straw was short.

Corn has likewise negative harmonies with water, by means of what are called the chaffs of its ear. These chaffs, called *calices* by botanists, in the case of other flowers, are a kind of polished, thin, elastic case, apparently destined to various uses, and arranged in straight or spiral furrows, so as to reflect the solar rays on the flowers. They cover the grains, and prevent them from being injured in their growth by the contact of different ears. Each of them is surmounted by a long soft point, called its beard, intended, not as Cicero imagined for keeping off birds, but to divide the drops of rain, which would otherwise waste the flowers, as happens so frequently in the case of those that are comparatively unsheltered at the top. We may therefore call these chaffs, with their beards, a kind of anti-hydraulic needle; and we accordingly find them used in packages for the purpose of preserving dry substances from moisture. But when they become open, on the maturity of the grain, and when heavy showers take place along with violent winds, they fill with water, and the straw, weighed down by its ear, is apt to yield, so that the greatest part of the field is laid, or, as farmers term it, *lodged*. The evil, however, is not without remedy, the corn generally recovering itself when it is not too thickly sown, or when the field has not been too

much manured. I have even observed, in cases where corn was laid, that detached stalks frequently keep their erect position.

The connexion, or harmony, as we term it, between corn and the ground, is kept up by the roots divided by filaments which suck their nourishment from the earth. These roots are neither long nor numerous, but their hold is so firm that we find it impracticable to remove them without carrying away a portion of the soil, and almost as impracticable to break the straw on account of its toughness. Accordingly labourers find it much easier to cut this vegetable than to pull it up by the roots. These relations with the ground are common to the corn plant with a number of other vegetables; but its peculiar property is that of being produced in some shape or other in every part of the world, from the rice of the Ganges to the barley of Finland. Like man, it is a cosmopolite, and Homer was, as usual, happy in his epithet when he called the earth "Bearer of corn."

Such are the soli-lunar, the aerial, the aquatic, and terrestrial harmonies of corn. Its relations with what we have termed the organised powers of nature are three in number, the vegetable, the animal, and the human. The first comprise the relations of the different parts of the plants

to each other, and have hitherto engaged but little of the attention of botanists, although to the eye of the agriculturist they form a prominent means of distinction. The proportional distances between the knots, the tubes of which become shorter as they approach the root, the colour of the leaves, and the shape of the ear, are all characteristics which discriminate it from other *gramina*. The corn plant has moreover relations of agreement with others of the same species, a collection of them forming, at one season, a field of beautiful verdure; at another, a vast harvest waving under the breath of the winds. Finally, we may mention, as a farther characteristic, the contrast between it and plants of a different genus, such as bind-weed, the blue-bottle, and the corn-poppy, but particularly the leguminous plants, as we shall find when we come to treat of moral harmonies.

The harmonies of corn with the animal kingdom arise principally from the extent of its leaves, as well as from the suppleness and tenderness of its stalk, which invite all animals of pasture to browse on it, and even to make it their couch. Amidst these stalks, thicker and more numerous than the trees of a forest, it offers a secure retreat to the timid hare, to the quail, the partridge, and the lark. Here likewise they find a supply of

food, first in the leaves and in the insects that feed on them, and subsequently in the grain when the plant approaches to maturity. It would be superfluous to enlarge on the connexion between man and a plant so important to his comfort and existence as corn. It is very remarkable that it no where grows spontaneously like other plants, so that Providence appears to have devolved altogether on our species the charge of maintaining and extending its cultivation. In fact, it forms the grand means not merely of human subsistence but of comfort, affording in its straw a supply for fuel, for beds, for roofs, for mats, and, in some countries of limited civilization, materials for crossing rivers. Bread is of all vegetable nourishment the most substantial and most durable. It would be an almost endless task to attempt to specify the variety of healthful and pleasant preparations of meat and drink extracted from the corn plant by the baker, the brewer, and the distiller; or to enumerate the domestic animals who may be supported by means of corn, such as the horse, the cow, the hog, the ass, poultry, &c. Corn not only gives the power of collecting various animals around human habitations, but it constitutes the first link in human societies, because its culture and preparation call for extensive labour and mutual service. The ancients

gave to Ceres the epithet of *Legislatrix*, and with great truth, since the primary regulations of an infant society originated, in all probability, from the necessity of preventing disputes in regard to corn.

Such are the harmonies, whether solar or physical, elementary or organised, of the corn plant. They exist equally in other species and genera of vegetables, but subject to a variety of modifications. By way of fixing our attention on a single object, we shall confine ourselves at present to what may be called the moral harmonies of corn, which, like the physical, are six in number, viz. three elementary, the fraternal, the conjugal, and maternal; while three may be termed complex, namely, the specific, generic, and spheric.

It is important to make a few observations on the distinction between physical and moral harmonies. The former belong to vegetables in particular; the latter to the different kingdoms of nature at large. It is well known that a plant neither sees, hears, nor moves like an animal; but it has, as well as the latter, its distinctive character, and, as has been ascertained in a recent age, the power of perpetuating its species. Physical harmonies vary from species to species, and from genus to genus, while moral harmonies are common to all. The inference is that physical laws

are of an inferior order to moral laws, in as much as the latter may be said to constitute the kingdoms of nature, and to link them together by kindred relations. It may be farther remarked that physical harmonies apparently belong to the elements, and receive from them only a transient extension, while moral harmonies seem to derive their origin and permanent character from above.

But to leave discussions which are beyond our reach, and to return to the properties of corn, we find that the first of its moral harmonies may be called without impropriety the fraternal; being that which constitutes a division of each plant into two equal parts affording each other mutual assistance. This distribution is not discoverable in minerals, and belongs exclusively to the living portions of the kingdom of Nature. It is conspicuous in the leaves, the flowers, and the seeds of vegetables, each of which consist of two equal parts; and it is still more conspicuous in the case of animals, whose members, in general, correspond exactly. A complete exemplification of it is afforded in the human constitution, and by our habits of imitation we have derived from this equilibrium an idea of symmetry, or, in other words, of a fraternal correspondence between equal parts.

This primary agreement is so apparent in vege-

tables that Linnæus has adopted it as one of the principal characteristics of his botanical system, under the name of *Adelphia*. However by confining it to the union of anthers in the same substance, he appears to have given it too little extension; for to me it seems to constitute the organisation of vegetables of all descriptions, since it exists in the leaf, the straw, the ear, and the grains of corn, all of which may be divided into two corresponding parts, agreeably to their upward or vertical direction; a circumstance the more remarkable, as the same parts present nothing but discrepancies, when classed according to their horizontal divisions. We may trace this fraternal connexion even in the tufts of corn, and in the leaves, the stalks, and the ears, which are there discoverable in miniature.

We come next to what is termed the conjugal harmony of the corn plant, and which we shall find contained in its flower. The flower is the organ for impregnating the plant by means of the solar rays, and it has generally a small corol formed of leaves called petals, which reflect the rays on the sexual parts. It has often likewise a calyx or outward covering to preserve it from violent winds, especially in the vegetables which have long and moveable stalks. The sexual parts are placed in the middle of the flower as in the

focus of a concave mirror. They are composed of a male and of a female part, the former being called *stamen*, and consisting of the *anther*, which has received its name from the Greek word ἀνθηρος, one of the various terms in that language which express love. It is commonly an oblong substance divided into two lobes, and kept in a state of equilibrium by a tough filament which becomes very thin towards the end. When the sun has acted for some time on it, the lobes become filled with a prolific dust called *pollen*, a term derived from the Latin *pollere*. The *pollen* impregnates the pistil or female organ of the flower, which is situated upon the *germen*, and extends itself in one or more filaments or styles, terminated in one or more *stigmata*. The stigma is a small opening adapted for the reception of the *pollen* which impregnates the *germen*, a process which takes place in a small receptacle called *placenta*. From all this it is apparent that the sexual parts of plants have a great analogy with those of animals, and that the generating process is accomplished by the same rules. In some vegetables the sexes are separated, as in animals, but in the corn-plant they are united. That plant possesses characteristics, in common with the other grasses, in its anthers which proceed from the flower and remain suspended from it, for the pur-

pose, no doubt, of being more exposed to the action of the sun. A similar community exists in regard to its calyx, which consists of two parts, as well as in regard to its corol, which is divided into two small valves, concave, and reverberant; but, on the other hand, it has the peculiarity of four flowers contained in a single calyx. This form of the ear is most suitable for the flowers of plants in a cold climate, because their petals, although less apparent, have more solidity and durability. This shape is consequently the most common; but it is when corn is in the flower that we see it clothed in all its magnificence. The dazzling poppy, the azure blue-bottle, the purple campion, the flesh-coloured bind-weed, all contribute to form a contrast to the lovely green of the corn-fields. The partridges and the quails make us perceive by their noise the pleasure with which they take up their abode amidst the rising plants; while the lark suspended over his mate and her nest, extends his notes through the air. The season of beauty is, among all the departments of organized beings, the season of love.

The harmony which I call maternal is exhibited in corn, in the precautions with which Nature covers the grain and provides for the growth of the seed. In some particular species, the calyx, which serves the purpose of the placenta, adheres

to the seed, and, like a sail, carries it to a distance when acted on by the wind; at other times the rough awn (as it is termed) at the end of the calyx has the effect of making it stick to the hair of cattle, and of being carried about for a considerable time with them. It is a curious fact that it does not admit of digestion in the stomachs of such animals as do not ruminate, and that it is sown anew along with their manure. Lastly, the resemblance of its shape to that of the keel of a boat makes it float a long time on the water, when it happens, as is often the case through carelessness, to be thrown into a river. Its grain is covered with a thick skin which goes by the name of bran, when separated from the mealy part. At one of its extremities it contains a bud covered with a small scale, which on being swelled by heat and moisture discloses an aperture over it, pierces the ground, and becomes a seminal leaf called *cotyledon.* This seminal leaf is its only sucking part, and receives nutriment on one side from the mealy substance of the grain, while on the other it sends forth a root, which soon finds a more plentiful supply of juice from the bosom of the earth. Notwithstanding the maternal care of Nature in providing for the deposition of its seed in the ground by means of wind, of water, or of quadrupeds, corn is said to be no

where found in a state of spontaneous growth. I am of opinion however that it does not fail to take root, but that if it is left without manure it degenerates into a species of grass, such as darnel. This opinion is suggested by the well-known fact that it cannot be cultivated for several years in the same field without labouring and manuring the ground. The notion of its degenerating into darnel is not only believed by many of the country people, but appears to be supported by the observations of the celebrated naturalist Bonnet. In his "Observations on Leaves," he remarks that he found one day a wheat-plant of a single stalk, bearing at its extremity a middle sized ear of wheat, and at one of its knots a pipe terminated by a beautiful ear of darnel. Duhamel, it is true, accounted for the formation of this mixed plant by the blending of the powder of their stamina; but Linnæus, on the other hand, has given probability to the idea of the transformation of parts of vegetables into a different species by the example of a ringent flower of toad-flax becoming, as botanists term it, regular. All that we can infer from the change of wheat into darnel, is that Nature has often thought fit to require the combination of the power of man with that of the elements, and that the hand of the labourer alone can enable wheat to retain its lead-

ing characteristics. It is at the time of corn becoming ripe, and on the approach of the sickle, that we perceive the emigration of a number of little beings from their maternal nests. It is then that the numerous family of the quail seek to lay the foundation of new tribes in countries warmed by other suns, and that the young of the lark, as the amiable La Fontaine says,

> Se poussant, se culbutant,
> Délogent tous sans trompette.

Let us treat in the next place of the social harmonies of vegetables; of those which connect vegetable families by species, genera, and spheres; and which are accordingly to be distinguished into specific, generic, and spherical. The harmony called *specific* is the source of the pleasure afforded us by an assemblage of vegetables of the same *species*. When we see a field of corn extended in long furrows like a beautiful green carpet, we experience a much more agreeable sensation than could be afforded by a few stalks or detached tufts. This pleasure is increased if the plain be covered with different kinds of corn, as with the bearded species along with spelt, rye, and barley. It receives a farther increase if the prospect be augmented by a valley covered with grasses of different kinds. A track of ground

thus variegated, when shaken by a gentle breeze, bears a resemblance to a sea of undulating verdure, each wave exhibiting a distinct shade of colouring. Their fugitive reflections, their distant murmurs, excite in our senses a calm and sweet repose; and if we analyze the cause of this delightful sensation, we shall trace it to the order in which those various plants are found to grow. It is remarkable that the pleasure afforded by any group of vegetables is greatest when they are planted in the ground in the order in which their seeds were arranged on the placenta. Thus, for example, a field of corn affords us pleasure because its plants are arranged by furrows in the same way as it grows on the ear; while a meadow delights us because the various species of grasses are scattered along its surface like their seeds in their diverging panicles. The oak which bears only a few acorns, sometimes only one, affords pleasure to the eye in a group of only two or three, or even as a single detached tree. Such a sight impresses us with a sense of the strength of this vigorous tree to which Nature has given the power of withstanding unaided the rage of the storms. On the other hand, we like better to see the slender firs lend each other a mutual support by their trunks, and vine stocks surround with

their leafy branches the sides of a rising ground, so as to form a compact group.

This law of harmony is applicable to all vegetable groups, some of which afford us pleasure when growing in a circular form, others in long avenues; and others when scattered in various directions. The rule for arranging them in seed plots is to be sought in the arrangement of their primary substances; a rule which is applicable to objects in every department of nature and taste. That rule is the source, till now unknown, of the most grateful sensations which we experience from the beauties of architecture, musick, painting, poetry, and eloquence. The arts afford no pleasure of which the foundation is not to be sought in nature. We shall enter more particularly into the illustration of this principle, on coming to treat of what may be called fraternal harmonies. Linnæus, as we have already mentioned, saw the existence of this principle in the assemblage of anthers on the same body, and gave it accordingly the name of *adelphia*. This forms one of the principal characteristics of his botanical system; but he has omitted to apply it to the vegetable at large, to its family, to its tribe, to its various species, and even to opposite genera. What harmony is found to subsist

among all these, and what delightful sympathies are we thus enabled to trace! At the same time, it is not merely for the pleasure of gratifying the eye, or even of affording a mutual support to vegetables, that Nature has thus diversified and grouped them. She exhibits varieties in the species of corn, according to the diversity of latitude, for the purpose of affording man a wholesome aliment in every clime. She has thus given us wheat in Europe, rice in Asia, panic in Africa, and maize in America. She has diversified, in like manner, the numerous species of grasses, agreeably to the wants of various descriptions of quadrupeds, birds, insects, and even fishes. In truth, *gramina*, or grasses, form the most extensive and most diversified genus of vegetables which exists. To characterize each species, we ought, in one point of view, to bring it under what we have styled in the present work, a particular harmony of nature; while, in another, we ought to connect it with that part of the animal kingdom for whose use it is intended. Botanists have divided grasses into several genera, and have subdivided them into species and varieties; but agreeably to our plan of classing by harmonic order, it is proper to speak only of species constituting a single genus. Of these species we reckon in our climate above

three hundred, of which thirty or forty are common in our meadows. The chief of these are the couch grasses, the different species of phalaris, fox-tail, cat's-tail, dog's-grass, quake-grass, the poas, the fescues, the bromes, wall and meadow barley, spring-grass, dog's-tail, soft-grass; to which are to be added the rushes of the marshes, the carices of the mountains, the cyperuses, and the flags. These, however, are only the grasses of our part of the world; and we ought to add to them those which extend from the torrid zone to the polar regions, such as the plantain, whose fruits, stalks, and leaves, afford to man in a primitive state both nourishment and a covering against the sun; sugar-canes, the bamboos of India, the canes of the Mississippi and of the river of the Amazons, the summits of which afford an asylum to ants on the occurrence of inundations; the papyrus-reeds on the borders of the Nile, the glaucous grasses which grow along the shores of islands in the torrid zone; together with a long list of unknown species scattered on the banks of rivers in the interior of countries; and in fact, throughout the extent of continents. I take a pleasure in contemplating our globe in relation to its grassy products only, and as displaying all the different species on its vast amphitheatres.

On one side we see the winds undulate the poa in the meadows; the quake-grass on the side of the mountains, and the carices on their arid summits. Every river has its reeds, from those which, buried during part of the year under snow, hardly raise their heads on the silent borders of the Irtis, to the perpetually rustling forests of bamboos along the Ganges, many of which attain the surprising height of a hundred feet. To the ocean of waters the earth opposes another ocean of moveable vegetables, and waves of verdure to waves of azure. On the one the storm rages without causing shipwrecks; for the tenants of the nest find under flexible stalks a comfortable retreat and a regular supply of nourishment. Perhaps it might not be going too far to assert, that the various species of *gramina* would of themselves be sufficient to supply food for the support of all animals; but Nature, in her munificence, has given infinite variety to the support of created beings; she has lodged a highly nutritive substance in the ear of corn, but oil, sugar, and wine she has bestowed on other vegetables.

We may thus trace several kinds of farinaceous substances in different plants, from the substantial ears of wheat to the slender product of the quake-grass, destined for the support of the smallest

birds. A similar variety exists in regard to the methods in which men manufacture the produce of corn into pastry, vermicelli, &c. All these modifications, however, are only species of one genus in the vegetable world. Let us proceed to the consideration of different genera.

The word *genus* is employed by botanists in a vague and often contradictory sense: they are in the habit of applying it to a family, a class, a division; and sometimes even to a species. Let us endeavour to proceed with more regularity. The word genus is evidently connected with that of engendering, or, to vary the phrase, with that of creating. The Genus is consequently a new order, discriminated by characteristics essentially different from other orders in the same kingdom of nature. According to our plan of reasoning, the distinction of genus bears a reference in one point of view to one of the principal harmonies of Nature; and in another to one of the principal wants of mankind. A species is merely a modification of a genus, and bears relation to the wants of one animal only. As the general harmonies of Nature are at the same time positive and negative, or active and passive; and as the same applies to the wants of mankind, it follows that genera are contrasted two by two in the same kingdom of Nature; and that species have

points of resemblance throughout the same genus. As we compute the number of general harmonies to be thirteen, it follows that the number of genera is double; viz. twenty-six. The genera being distinguished by contrast, we shall find a harmony of the most agreeable description resulting from joining two and two of them together. Let us examine, with this view, the leguminous plants and the grasses. The latter appear to have a relation to the aërial harmony; and on considering how far this extends, we find it exists in a positive shape in the leaves which, whether in straight or waving lines, escape from the action of the wind. It exists likewise in respect to the half concealed flowers fixed behind the ears; in respect to the stalks, perpendicular, hollow, knotty, and elastic, which are found to recover almost invariably an upright posture, notwithstanding the shaking of the storm or the trampling of the quadruped.

The leguminous genus, on the other hand, is marked, in relation to the winds, by negative harmonies. They either lie along the ground, or they attach themselves by their tendrils to a grassy plant. Their broad leaves are generally collected three together by flexible foot-stalks; while their branching stalks are filled with pith, their flowers are displayed in the shape of a

butterfly; but the sexual parts are covered by a keel. The flowers are supported by crooked stalks, elastic like springs, so that they turn round like vanes on the slightest agitation by the wind; and oppose to it their calyx. They are grouped in clusters, and yield, in the coverings which serve to shelter them, seeds, either in the shape of kidneys, or round, as in French-beans and peas. The growth of the grassy tribe is perpendicular; that of the leguminous plants is horizontal; so that the former rise without difficulty across the latter, and bear them up whenever they are in a situation to receive their support. To form an idea of their harmonies, let us begin with that which subsists in the case of the different kinds of corn. A district which is covered with a yellow harvest bears also a crop of beans and peas, forming a delightful contrast to the other in point of foliage, verdure, and flowers. This is strikingly exemplified in the mode of culture pursued by the savages of North America, who are in the habit of sowing their maize on small clods of earth, to the number of nine grains in a circle. Along with this they plant an equal quantity of beans, the stalks of which fasten themselves to those of the maize, and form altogether a charming assemblage; the contrast of the different parts having a

very pleasing effect. It is worth remarking, *en passant*, that beans have been coupled in diet with corn among almost every nation of the world. They form, along with bread, the principal nourishment of the French people; and the Chinese are in the habit of extracting from them a liquor called *soui*, which they employ to season a variety of their dishes. We may even remark that, to judge from the food cultivated for our domestic animals, the taste of the brute creation bears in this respect a considerable resemblance to our own. While meadows are covered with grass for their consumption, the neighbouring fields produce for them vetches, lucerne, and sainfoin. Of the different kinds of artificial grass, that which pleases them most is the mixture of oats and peas, known in France by the name of *dragée*. That harmony which we observe in our own meadows may be traced in remote and half-cultivated countries; it may be found even in the glades of the Island of Tinian, in the midst of the vast Southern Ocean. Admiral Anson imagined himself transported to an English farm, on seeing pasturages consisting of grass and clover covered with numerous herds of white cattle; and enlivened by the crowing of the cock. The cattle had probably been carried thither by Spanish settlers; but there seems no

doubt that the product of the meadows proceeded entirely from the hands of Nature. Even I, who have had only occasional opportunities of observing the various proofs of harmony in Nature, have seen in the Isle of France small trees bearing a leguminous flower of a lilac colour, and known by the name of *agathis*, form by dint of contrast a delightful grove, when growing along with bamboos, the largest of the tribe of gramina. It is thus also that, in the Alps, the yellow-flowered anthyllis forms a delightful bower around the tapering firs.

In the next place, with the view of forming a clear idea of the genera in the vegetable kingdom, we shall make choice of the prototypes, or first models, produced under the equinoctial line. After explaining their relation to the primary wants of man, we shall endeavour to determine their genera by bringing them successively in connexion with the thirteen active and passive harmonies.

The first of these harmonies are connected with the elements, and may be termed the solar, the aërial, the aquatic, and the terrestrial. They are displayed in the general division of vegetables into trees, grasses, aquatic plants, and different kinds of moss. These classifications are not indeed sanctioned by the adoption of naturalists;

but they appear to me to exhibit at one view the compass of the vegetable kingdom, and to be within the reach of every one's capacity. They will be found applicable to the other kingdoms of Nature; and, among animals, to quadrupeds, birds, fishes, and insects; while, by a farther process of reasoning, we may trace their existence in the human constitution: I mean in the four distinct temperaments, the bilious, the sanguine, the phlegmatic, and the melancholic. The sun, as we shall see, has frequently a powerful influence on trees, on quadrupeds, and on the bilious temperament in man; while the air operates on grasses, on birds, and on sanguine temperaments; water on aquatic plants, on fishes, and on the phlegmatic constitutions of individuals of our own species; and finally, the earth exercises an influence of the same kind on the different species of moss which vegetate on its surface, on the innumerable insects which are harboured in it, and on the class of mankind whose temperament is melancholic. Again, we may apply this elementary division to the human species at large, who present four distinct descriptions of character, according to their situation on plains, on mountains, on the sea-shore, or in the interior. Lastly, the globe itself may be said to have in each of its four great divisions

some connexion with a particular element: the burning sands of Africa bespeaking the influence of the sun; Europe, always in political movement, appearing to partake of the changeable nature of its atmosphere; while the phlegmatic character of America may be compared to that of water; and the grave and melancholy features of the Asiatics may be supposed natural in a region where a vast tract of land remains unbenefited by water communication.

Again, the inhabitants of the four quarters of the globe may be said to possess a character somewhat analogous to the divisions of the animal kingdom. The African negro may not improperly be said to have the strength of quadrupeds; Europeans are active, and have become the boldest of navigators, by making, like the winged species, a useful application of the power of wind; the Americans are particularly habituated to swimming; while the Asiatics cultivate the ground with the patience of the most industrious of the animal tribe, and afford, in the case of the Hindoos and Chinese, examples of considerable success in agriculture.

To return to the divisions of the vegetable kingdom. By commencing with what is termed solar harmony, we shall perceive that trees evince an immediate relation to the sun by the concentric

rings of their trunks. The number of those rings is always equal to the number of years that the tree has been in progress of growth; in other words, to the number of the annual revolutions of the sun. Trees give evident signs of life, and continue to do so, as is well known, for ages. Their genera are much more numerous in the torrid than in the temperate zones; for I brought back no less than forty-two distinct kinds from the Isle of France, which is only twelve leagues in diameter, while it is said that there do not exist above sixteen or seventeen species in the different forests of France.

The genera of grasses, on the other hand, are more numerous in the temperate zones; and those of moss in the frozen regions. Nature, which puts refreshing and aromatic fruits on trees in the torrid zone, such as the calabash, the papaw-melon, and spice-trees, often produces them in our climates on a humble and creeping stalk, such as those of gourds, savory, thyme, basil; and she scatters flavours and perfumes amongst the mosses of the north. It is remarkable, that the grasses in our country are productive of species which in the torrid zone attain the size of trees: such as the Indian bamboo, of the genus of gramina; the mallow of Africa, of the genus of the malvaceæ; and the plantain in that

of the flags. It is by no means impossible that some species of moss may be found to attain the size of a shrub in parts of the torrid zone, and that it may have been confounded there with some description of fern, which in that latitude is so common and so lofty. At the same time I should admit that the moss, as far as we yet understand its nature, belongs to a cold latitude. I have seen innumerable varieties of it in Finland, although I did not proceed in that country beyond the sixty-second degree of latitude.

If the sun infuses so much activity into the vegetation of the torrid zone, and if he impresses marks of his annual course on every tree, the moon appears to exercise a decided influence on herbaceous plants. I have observed in the roots of these plants, in our gardens, concentric layers, always equal in number to the lunar months that had elapsed since they were in growth. This characteristic may be traced particularly in carrots, in beet roots, and in the bulbous part of onions. It was possibly on this account that the Egyptians thought proper to consider the onion as sacred to Isis; the name under which they addressed their adorations to the moon. At all events, it is certain that such roots have in general seven concentric rings; that is, a number equal to that of the months elapsed in the course

of their growth, as they are generally sown in the beginning of March, and gathered in the end of September. In countries where the vegetation of these plants lasts more than seven months, I am inclined to think that their roots have a greater number of layers, and that in some cases they equal those of the lunar months of the year. A prolonged growth of this description is no doubt the reason that the Egyptian onions are remarkable for their size, as is the case with the roots of all the bulbous plants of Africa, and the countries in the torrid zone. The marks of lunar periods are to be found likewise in the knots of the stalks of most grasses; and indeed are so open to observation in their shoots, that I consider them as affording a distinctive characteristic between those plants and trees properly so called, although in warm countries gramineous plants sometimes attain a height not inferior to that of trees. According to Rumphius, the bamboo in India throws out a shoot every month: and Francis Pyrard reports, that at the Maldive Islands the cocoa-tree produces every month a cluster of cocoa-nuts, so that no less than twelve are in bearing at a time: of which the first is in a state of incipiency; the second coming out of its covering; the third budding; the fourth in flower; the fifth forming a nut; and the last in maturity. The fan palm,

which grows on the borders of the sea, bears, in like manner, a new leaf once a month. Naturalists are aware that palm-trees have not the annual concentric rings, and that their trunk is not, strictly speaking, composed of wood, but of a number of fibres mixed with a pithy or medullary substance. It differs farther from other trees in coming out of the ground with its full thickness: it has moreover only one cotyledon; a circumstance in which it resembles the grasses. According to this distinction, the palm-tree may be called an herbaceous plant on a large scale, and discovers by its shoots the operation of lunar influence; while trees strictly so called, even of the smallest size, display in their annual rings the effects of the action of the sun.

We ought also to reckon among the vegetables exposed to lunar influence the different kinds of mosses; most of which are found to flower only in winter, the season when the moon is in our hemisphere. The case is perhaps the same in regard to sea-weeds; for since naturalists ascribe to the moon so much power over the waters of the ocean, they can hardly refuse her an influence on the vegetables, and even on the fishes, which find a support in its vast expanse. At all events it is clear that the moon exercises a sensible operation on the four orders of the animal

kingdom, and even on the human species. It is well known that quadrupeds have their regular seasons for love, and for the deposit of their young; and the same is applicable to the laying of eggs by birds. I have farther to observe, that the bones of birds seem to be renewed periodically, as appears from the alternate streaks of red and white in the case of such fowls as are fed occasionally with madder. Similar streaks exist in connexion with the lunar months in shells of various descriptions, among others in oyster-shells; and their number appears to be indicative of the number of months that the animal has enjoyed life. It would be easy to extend the application of lunar influence to the case of insects; but we postpone this part of the subject until we come to treat of the animal and human part of the creation.

Although trees discover an immediate connexion with the sun by the concentric rays of their trunks, they are evidently subject likewise to the operation of the moon by the thin layers on their bark and on their fruits. I have observed no less than seven of these layers in the bark of the birch; and I have likewise thought them perceptible in each of the annual rings of trees. I cannot help likewise thinking that I have traced them in particular fruits, especially in the rennet

apple. They are discoverable when we open that fruit in an oblique direction, and particularly when we divide it by biting with the teeth instead of cutting it. All these different circumstances afford new evidence of the operation of lunar influence on trees; for it is well known that, in our climates, the time for their vegetating and becoming ripe does not exceed seven months at the utmost.

In pursuing our analyzing process, we shall find that vegetables have soli-lunar harmonies, not only in their roots, their stalks, their bark, but even in the inside of their fruit. A more apparent kind of harmony is found to exist in their petals, or flower-leaves. The petals, like mirrors, reflect the rays of the sun and moon on the sexual parts of the flower. Most flowers have their contour circular, and it is generally in the middle that the sexual parts are placed. Their disk is occasionally raised hemispherically, and exhibits something of the appearance of a star, when surrounded by flat and diverging petals, as in the case of the radiate flowers. This approximation to the figure of a star is so conspicuous in some of the species, that botanists have classed them by the name of *aster;* but a similar remark might be made of the majority of flowers, which, as we have already observed, are almost

all circular in their outline, however different in their stalks and leaves. It is evident that this shape is most favourable for reflecting the rays of the sun to a common centre; and that the superintending hand, which shaped the reflectors of planets into rings and curves for the purpose of receiving the solar rays, diversified the petals of flowers with the same beneficent intention. It is owing to this reflection, or reverberation, that flowers possess a brightness which makes them appear to a certain degree luminous. For my part, when I look on the flowers which embellish a meadow with a rich variety of shape and colour, I am inclined to adopt the notion, that they may be considered as bearing some resemblance to those of the heavenly bodies, with which we are as yet very little acquainted Is it unreasonable to think that Nature should have afforded in the flowers of the earth resemblances of those objects which she has stationed in a higher region; since she has impressed on man, whose existence, like that of plants, is transitory, so strong a reverence for that all-directing mind which regulates the universe?

The farther we carry our botanical researches, the more we are surprised at the deficiency which has hitherto existed in regard to a knowledge of flowers. We have continued to tread on this

attractive part of creation, age after age, without knowing what was below our feet; and to the present day almost all the inhabitants of the country are unacquainted with the sexual distinction of plants. But why should I say the inhabitants of the country? since it is well known that when Le Vaillant first started that theory in his lectures, in the Jardin des Plantes at Paris, the celebrated Tournefort obliged him to keep it in the back ground, and would not acknowledge its accuracy; a reluctance which, I fear, we must ascribe to his not having been the author of the discovery. A feeling perhaps equally unkind influenced my botanical contemporaries in rejecting the theory of the harmony existing between the petals of flowers and the sun; a harmony of which I have adduced a variety of proofs in the "Studies of Nature." They make however some amends for this, by considering those petals as the most discriminating characteristics of flowers, which they class into monopetalous and polypetalous; subdividing the latter into radiate, rosaceous, papilionaceous, &c.; but without any regular plan or arrangement.

To avoid the obscurity attendant on such systems, we shall endeavour to guide our steps by a clearer light. The petals of flowers are disposed either in perpendicular spikes, as in the case of

corn; in a radiate form or like plane mirrors, as in the case of the daisy; in spherical segments, as in the rose; in elliptics, as in the lily; or in parabolic forms, as in the monkshood. These are their principal shapes; and although many others belong to curves, which are unknown or imperfectly ascertained, the whole are generated from the spherical form. It deserves notice that, when the petals are radiated or in plane mirrors, the disk of the flower is in a hemispherical shape, for the purpose, no doubt, of receiving their reverberations. This is exemplified in the case of the daisy and camomile. The petals fold back, or fall off, after the task of impregnation is performed. The disk is somewhat concave in the sun-flower, and it often happens that the florets in its centre prove abortive, and yield no seed. Its concavity proceeds perhaps from change of climate, this plant being a native of America. The reflectors, in the case of the rose-shaped flowers, have one common focus; in the lily tribe they have two; while in the case of the parabolic shape, as in the vine, the rays are conveyed in a parallel direction. The flowers are sometimes in clusters; or in umbels, as in the carrot; sometimes in a hemispherical shape, as in most kinds of clover; at other times in diverging rays, as in the case of cabbage, and of most of the cruciform

flowers. In addition to the positive relations existing between the sun and flowers, we shall find several of a negative character. Some of the labiate flowers show only the extremity of their anthers; and some of the papilionaceous, or butterfly kind, conceal theirs by means of a keel. Other kinds expand only during night, as the marvel of Peru, the nyctanthes, or *arbor tristis* of India, which opens regularly as darkness comes on, and closes at day-break: a case similar to that of the nocturnal convolvulus, which is also an Indian plant. Other flowers are pendulous, and hang in the shade of their leaves, as the crown imperial, and many of those that belong to hot climates. Linnæus had perceived the connexion of the petals with the presence and absence of the sun; and had remarked that several of them opened or shut at particular hours of the day, such as those of the dandelion and wild succory. He had observed, likewise, that most of them closed at night-fall, and had even formed a kind of botanical time-piece from these data. One additional step would have enabled him to discover that the petals of flowers are real reflectors, in harmony with the sun, and that their duration is in the inverse ratio of their action on the sexual parts. The petals with spherical outlines, or the rose-shaped flowers, are those which have the most activity, because they transmit all

the solar rays to a common centre. They are likewise the shortest in point of duration, the rose being an ephemeral flower, and affording a favourite image to philosophers to express the fleeting nature of our pleasures and our existence.

It follows from the preceding reasoning, that the vegetable kingdom may be divided, with reference to the sun, into vegetables of the torrid, temperate, and frozen zone; into vegetables of winter and summer, of day and night. The consequence is a great number of genera, both positive and negative, in trees, grasses, sea-weed, and moss.

I have already pointed out how useful and comfortable, in various respects, the plantain-tree is to our species. The longer we continue to observe it, the more we shall be struck with the extent of the advantages of this valuable gift of Nature.* The stem of the plantain-tree is in general nine or ten feet high, and is formed of a compact body of leaves, at first rolled up in a peculiar manner, but which, by expanding at the summit of the tree, form a magnificent parasol. These leaves, of a beautiful satin green, are in general a foot in breadth and six feet in length; they incline downwards at their extremities, and form by their curves a delightful bower, impenetrable to the sun and rain. As

they are very supple, the Indians are in the habit of making out of them vessels of all kinds to hold water and food; they cover their cottages with the leaves, and they find means to draw a quantity of thread from the stem after drying it. A single leaf affords an ample covering for the middle of the body, and two leaves are sufficient to cover the body from head to foot, before as well as behind. I happened one day, when walking in the Isle of France, amid some rocks at the sea-side, to observe two negroes, one holding in his hand a pick-axe, the other a spade, and carrying on their shoulders a bamboo, with a long package wrapped in two capacious leaves of the plantain-tree. I imagined at first that this was a large fish which they had just caught, but it proved to be the body of one of their unfortunate companions in slavery, to which they were about to pay the last respects in that sequestered spot.

This valuable plant produces its fruit in the hot-beds of our climate only once in three years, as I have observed in the Jardin des Plantes at Paris; but, under the line, its produce is annual, and the stem which has borne the fruit falls forthwith into decay. However, being surrounded by a dozen shoots of different sizes, all bearing fruit in their turn, the consequence is an unin-

terrupted supply and a fresh stock every month, as in the case of the lunar clusters of the cocoa-tree. This observation must be understood as confined to the plantain-trees growing under the line, and on the borders of rivers, which is their natural position. Among the numerous varieties of this plant, there are stems from the height of a child to that of a full-grown man. I have seen in the Isle of France dwarf plantains, and others of a gigantic size, transplanted from Madagascar, and bearing long and curved fruits, known in familiar conversation by the name of *ox-horns*. These fruits were easily gathered by a man climbing up the side of the stalk, and resting his feet on the projecting part of the old leaves; while the higher fruits were gathered by a person placed on the shoulders of another. A single fruit furnished a meal for a man, and one of the bunches was food for a day. There is a great variety in the taste of the plantain; for though I have eaten them only in the Isle of France, which is situated, as is well known, at the extremity of the southern torrid zone, I found, in the dwarf species, a very agreeable flavour of saffron. The ordinary kind, called the banana fig, is unctuous, saccharine, mealy, and tastes somewhat between the pear called *bon-chretien* and the rennet apple. Being of the consistency of fresh butter in the winter

season, it needs no teeth for its consumption, and is accordingly equally suitable to an infant as to those who have lost their teeth by age. It contains, as far as we can see, neither seed nor what botanists term *placenta*, as if Nature had intended to remove whatever might stand in the way of the supply of human food. A farther important advantage is that, though covered by a single skin only, it is never attacked until completely ripe by insects or birds; so that, if plucked a short time before-hand, it ripens completely in the house, and may be kept for a month in the best condition.

Plantains are very various in taste, and are better the nearer they grow to the equator; that is, the more they are under the direct influence of the sun. In the Molucca Islands in particular their flavour is exquisite; some having a scent of amber and cinnamon, and others of the orange flower. They are to be found throughout the whole torrid zone, in Africa, in Asia, in America North and South, in the islands belonging to each continent, and even in the most distant islands of the South Sea. The *rima*, which bears the bread-fruit in Otaheite, is not to be compared with the plantain, although some late philosophers expatiate on that tree not only as a new discovery, but as the most valuable gift of Nature to

man. I consider it the same as the tree which has long been known to grow at the Moluccas, and has been mentioned by a number of travellers. Moreover, its utility to man is much less extensive than that of the plantain, in as much as it supplies neither lodging, clothing, nor furniture. Six or seven years are required to bring it into bearing, and it affords a supply of fruit during eight months only in the year. If it afforded for the first time a substance so nearly approaching to bread as to become, we may almost say, crust and crumb by being put into an oven, we are to consider, on the other hand, that the flavour of the plantain is such as to supply the want of butter, sugar, and spices. The bread-fruit-tree gives bread in a pleasant but in a plain shape, while the plantain supplies what may be called the delicacies of pastry.

After these statements of the excellence of the plantain, we need not be surprised that Dampier, the well-known traveller who made the tour of the world with so much discrimination, should call this tree the king of vegetables, to the exclusion of the cocoa-tree, on which seamen are accustomed to confer this title, because their observation is necessarily limited to objects within their reach. Dampier observes that a number of families between the tropics derive their support en-

tirely from the plantain, and it is no doubt on account of its aptitude to meet the wants of man in a state of inexperience, that the Hindoos have called it Adam's fig-tree. The superstitious Portuguese, on landing in India and observing the plantain, imagined that they saw, on cutting its fruit cross-wise, the token of redemption in a kind of cross, which I have never been able, I must confess, to perceive in this fruit. However it exhibits in its capacious leaves a very proper covering for our first parents, and may even be said to suggest to the imagination in its top, loaded with fruit and terminated by a violet cone containing the corols of its flowers, something like the head and body of the serpent who held forth the deceitful gift to our first parents. The Brahmins prolong their age to an advanced period by means of the healthful fruits and delightful shade of this tree. It is found no less than six degrees on the outside of the torrid zone, and is called by the Arabs *musa*, a name that has been adopted by our naturalists. The Arabs having been instrumental in diffusing the elements of science in Europe, after the decay of the Roman empire, it is not quite improbable that the word *musa*, so frequently introduced in Latin rudiments for the use of children, had reference, not, as is vulgarly supposed, to a muse, but to a tree of which the

fruit was well known to be so acceptable to the palate.

The variety of advantages combined by Nature in the plantain, I mean the taste of sugar, wine, flour, and butter, are found separately in other plants, and appear to have been united in the plantain with the view of teaching man the propriety of conjoining them. The other plants to which I allude are found in situations where the plantain does not thrive; a sheltered spot in the bosom of a valley, and on the bank of a rivulet, being indispensable to the growth of that tree, and to the preservation of its tender leaves from the blasts of the tempests. The palm-tree, on the other hand, has leaves calculated to resist the rudest winds, and to thrive in a variety of situations, from the summit of the mountain to the margin of the ocean. While the plantain is more particularly fitted for the supply of a family or single household, the larger variety of fruit, in the case of the palm-tree, may be considered as adapting it to the support of a great number of persons.

I am inclined to consider the plantain as a species of flag; and allow that we ought to class under the same description the *cannæ*, or Indian flowering reeds, which bear grains of various kinds, and whose broad leaves are

rolled up and enclose each other; but they do not become expanded in the shape of a parasol, nor do they afford man a direct supply for his wants.

The various plants I have mentioned, without excepting the palm, appear, notwithstanding their magnificent growth, to belong to the genus of gramina, because their first shoot has only one cotyledon, and their leaves, being enclosed one within another, are merely evolved in the progress of growth. The consequence is that the stem or trunk has, from the beginning, the same breadth as when the plant has attained its height: moreover, it is without bark, and contains nothing of what can properly be called wood. The trunks of the palm are merely assemblages of fibres without concentric rings, and are more tender in the middle than in the outside. The case is quite otherwise in regard to trees properly so called, their trunks increasing their diameter every year, and the augmentation being marked in the inside by rings. Moreover, they are, as every one knows, covered uniformly with bark, and have the soft part of their wood on the outside with the hard part in the middle. Another point of resemblance between the palms, and gramina consists in their being affected by lunar influence in the growth both of their leaves and fruits. While

trees bear in the inside rings in correspondence with the annual revolutions of the earth round the sun, the palm is marked by similar tokens on the outside. The former consist of concentric columns, the latter of a succession of marks, like a drum, placed one above the other. It is worth observing that while in the case of trees the signs of age are kept out of view, they are prominent in the palm. The latter pushes out every lunar month either a leaf, as in the case of the fan-palm, or a stock of fruit, as in that of the cocoa-tree, and its whole top acquires an addition to its height. When the new palms come out the lower ones, being older, fall, and leave on their trunks rough notches like rings, which serve both as steps to climb up to its top and as marks indicative of the age of the plant. The palm may consequently be called the most chronological of plants, being a dial which marks the hours by its shade, the lunar months by its fresh leaves, and the years by the rings around its trunk. Its different species are at least eighty in number, and have each several varieties completely distinct from each other. It grows in almost all countries and situations throughout the torrid zone, and is even found to thrive at the distance of six degrees beyond it. There are, no doubt, various other

species which have hitherto eluded the observation of botanists.

No vegetable bears such evident marks of the existence of what I have termed soli-lunar harmonies; and its relations to man are no less numerous and remarkable. To begin with the size of the trunk: we find none of a circumference beyond the grasp of our extended arms, and the stalk is, as has just been remarked, easy to climb by means of the projecting rings. I have seen the negroes, in the Isle of France, ascend the cocoa-tree in this manner with the greatest dispatch. It is remarkable that the cocoa-nut, when stripped of its outer coat, presents with its three crevices a perfect resemblance to a negro's head. But as cocoa-trees are familiarly known it may be preferable to look for such resemblances in the date-tree. This stately vegetable combines in itself the advantages of most other palm-trees, and appears indeed the leader of the species; its fruits affording delightful food, and exhaling the most agreeable perfumes. Its trunk attains a height of at least forty feet, and is always found standing erect in contradistinction to that of the cocoa-tree, which is often bent by the wind. Its spadix is about six feet high, and bears long leafy branches extending above

fifteen feet, and known by the name of *palms*. The leaves on these branches are placed obliquely and alternately, like the bearded part of a feather. They are about a cubit in length, and two inches in breadth; being pointed, woody, and similar to the blade of a poignard, or the leaf of a reed. The palms which bear these leaves are in general about 120 in number, one-third of which are perpendicular, and the other two-thirds sloping and horizontal; so that at the top of the tree they form a head, the ground plan of which is circular, and the elevation conical. From the divisions of the upper palms proceed thick coverings or sheaths to the number of eight or nine, very firm on the outside, and very smooth within. These sheaths on opening give birth to a cluster of flowers, which are changed into fruits as soon as they are impregnated by the flowers of the male palm-tree. These fruits are the well-known dates shaped like the mouth, and disposed two by two on strings in a zig-zag direction. Every cluster contains about 200, which are green during the progress of their growth, and of a gilt colour when ripe. Their taste is delicious while fresh, and they may be kept a twelvemonth in a dry state; but although very nutritive in the latter case, their taste is as different from that of the former, as the taste of a

dried from that of a fresh fig. These clusters are nearly of the size of a man, and hang loaded with their yellow fruit around the top of the palm-tree surmounted by its beautiful green leaves, which form a magnificent canopy above them. Lastly, Nature, in the extent of her foresight, has protected the lower part of the leaves and clusters of the palm-tree from the agitations of the wind by three or four coverings of net-work, as strong as hemp, and similar to rough yellow tow. It often happens that the turtle-doves make their nests in the folds of these coverings as if they were so many folds of drapery.

The products of the palm afford a daily supply to the wants of many nations. The Arabs and the Hindoos live upon its fruits, and make use of the hard kernel after boiling it, as food for their camels. They make vases with the sheaths, cloth with the net-work, the carpentry of their houses with the trunks, and their roofs with the leaves. A minute account of the various uses of the palm, and particularly of the cocoa-tree, is to be found in the works of travellers; one of whom, Francis Pyrard, has been particularly explicit in regard to the palm-tree produced by the sea-side. But as few travellers or naturalists have treated of the date, I prefer directing the reader's attention to it. The breadth of its top will be found equal

to the height of its stem or trunk below the leaves. On measuring the breadth of the top, from the extremity of one of the horizontal palms to that which is diametrically opposite, you will have sixteen feet for each palm, and two feet for the diameter of the trunk, making in all thirty-four feet, which is the ordinary height of the trunk all the way up to the leaves. The crown of this trunk formed by the palms is of seventeen feet in height. The palms being of sixteen feet, and the top of the trunk supporting them being of six feet, it seems at first that we should have a length of twenty-two feet; but as the palms are arranged one above the other, the length of sixteen feet exists only in the lower ones which have attained their complete expansion: and as the palms on the summits are only of eleven feet, we find here the number of seventeen, by taking in the six feet already mentioned of the top of the trunk. The proportion is nearly the same in the case of the plantain, whose leaves are about six feet in length, and the stalk or trunk nearly twelve feet. But as the plantain leaves proceed from one common centre, they are comparatively less elevated at the top; in each case the height is to the breadth in the proportion of one and a half to one.

The proportion thus existing in the palm-tree seems the most agreeable model of any, whether

we apply it to laying out an avenue, or to the proportions of a drawing-room. The degree of its height produces something like the impression of infinity, and forms the characteristic mark of the Gothic, or rather Saracenic architecture in our churches, whose lofty vaults, supported by pillars, present, like the top of the palm-tree, a kind of aërial appearance, calculated to inspire more religious awe than the Grecian architecture. The latter, notwithstanding the regularity of its orders and the beauty of its pillars, has often a heaviness in its vaults, because their height is not sufficiently great in proportion to their breadth.

If the palm-tree presents in its whole the finest proportions for the height and breadth of vaults, it offers likewise in its stem the most beautiful model for the pillars which support them. The Greeks claim the merit of inventing the Tuscan, Doric, Ionic, and Corinthian orders, and are said to have taken the proportion of the Ionic column, and the volutes of its capital, from the proportion and dress of an Ionian girl. It is likewise said, that the Corinthian capital was taken from a plant of acanthus, on which a basket had been accidentally placed. These, however are evidently fictions, as Nature had long before presented various models in the date-

tree to the Asiatics, as we may still see in the ruins of Persepolis at Chelmina, where the pillars have capitals in the manner of palm-leaves.

Though I have hitherto said little of the harmonies existing between man and vegetables, I must not be understood as rejecting them; but as desirous to admit only those with which I happen to be well acquainted. It is not impossible that on comparing the stature of a young girl with the breadth of her face, we may find, as has been said, a difference of proportion according to her time of life, and may discover cases in which the stature has, in infancy, seven times the breadth of the face; a few years after, eight times; in her more advanced youth, nine times; and ten times, when the body has acquired its complete formation. Nor is it impossible that these proportions may have served as a basis to those of the different orders of architecture; but it is very unlikely that the Greeks, nursed in the bosom of liberty and of taste, should have given to a vertical shaft, intended to support an immense weight, the proportions of a female; or that they should have thought of imitating her shape by a cylinder, the folds of her clothes by the fluting of pillars, and the contour of her head-dress by volutes. Is it not more likely that the trunk of the palm-tree afforded the first

model of a pillar, by its perpendicular attitude and the equality of its diameters; as well as that it suggested the cylindrical *tambours* in the Tuscan order by its annual rings? I am inclined likewise to look for the first notion of fluting the shaft, in the vertical crevices of the bark, which serve to convey to the root of the palm-tree the rain that falls on its leaves. I am farther inclined to trace the volutes of the Ionic capital to the first circles of the sheaths; the Corinthian capital to the leaves of its palms; the proportions of the different orders to the height of its trunk at different ages; and finally, the plan of arranging columns together to the manner in which the palm-trees are found grouped by the hand of Nature.

The trunk of the date-tree seems intended for the support of a large burden on account of the extent of its top, which, if not heavy in itself, becomes very difficult to bear up when shaken by a tempest. This tree is found chiefly on the side of rivulets in the stormy deserts of Arabia, where the wind raises tempests of sand, which too often prove the destruction of entire caravans. The other species of the palm-tree seem all to delight in exposed situations, from the cocoa-tree which grows in the sea-sand, and the fan-palm which grows on its shores, to the palmetto

on the summits of the mountains. It is, no doubt, on this account that, however different the several species may be in other respects, their stems invariably consist of a quantity of fibres, stronger on the outside than on the inside; while the leaves on its top are not merely of a woody substance, but elastic and stringy. The date-tree, like other species of the palm, has from the beginning of its growth a diameter which remains invariable, whatever may be the height of its stem; while the diameter of the trunks of other trees increases, as is well known, with their height. This permanency of diameter in the date-tree gives it an additional claim to the honour of having suggested the idea of the column; the diameter in the latter being of course invariable, and serving as a rule for the proportional height. In the column, the Tuscan order is in height seven times the extent of its diameter; in the Doric eight times; in the Ionic nine times; and in the Corinthian ten times. Now as the proportion of height to breadth is the only constituent of the different orders, several eminent architects have reduced the latter to the number of four; rejecting the Composite order because its proportions are the same as the Corinthian. They are accustomed to say that a column appears too thick, when less than seven times the

length of its diameter; and too thin when more than ten times. They do not give their reasons for this rule of proportion; but as we are justified in supposing that there exists in nature a ground for any feeling that is entertained in common by us, we need not wonder at their looking for the fundamental rule of the proportions of the column in the different proportions of the human stature, to the breadth of the head in the four periods of our growth; although the original idea of the column was doubtless taken from the trunk of the palm-tree.

We shall find, however, these different proportions distinctly pointed out in the growth of the date-tree. Supposing it planted in a favourable soil and climate, we find it on coming out of the ground two feet in diameter. Seven years nearly elapse before it is properly formed, or has acquired the height of two or three feet. Its trunk is then hardly visible, and seems at first only like a large tuft; but it soon begins to grow with more rapidity. In the eighth year it may be said to drop its infant state, and to reach the height of the human stature. In the ninth year it is eight feet high; in the tenth year ten feet; in the eleventh twelve; in the twelfth fourteen; in the thirteenth sixteen; in the fourteenth eighteen, at which time it begins to show its

covered top. In its fifteenth year its height is twenty feet; and it begins to bear fruit. A correspondence in point of years and progressive growth may be remarked between the fair sex and this valuable tree; and Homer has very happily expressed the coincidence, when he makes Ulysses say to the princess Nausica, on perceiving her at the sea-side: "The transport I experience on seeing you can be compared only to that which I felt on beholding at Delos a young and magnificent palm-tree raised all at once near the altar of Apollo."

This tree offers the finest model for the column, before it has attained its complete height; and when, as a poet would say, it is in the flower of youth. All that season its verdant palms are in a state of regular increase, and raise themselves towards heaven in spite of the rage of the tempest. It is when arrived at this height that we see the turtle doves come with confidence to fix their nests in its drapery; and that the architect takes from it a rule of proportion for those Corinthian columns, with which the Greeks were in the habit of ornamenting the temples of the gods. The Italian architects, on observing the beauty of the vine loaded with leafy branches and grapes, when twined in a spiral form around the naked trunk of the palm-tree,

imagined that they might successfully imitate the graces of nature by giving a twist to the column; but the attempt was unavailing, and produced nothing but an unnatural piece of workmanship on the most celebrated altar at Rome.

The date-tree continues to raise its stem in majestic simplicity until it attains the height of more than forty feet. The slenderness of this proportion presents in its combinations new beauties for imitation in the Saracenic architecture. Perrault was sensible of this when, on placing two by two the columns at the peristyle of the Louvre, he gave them a twentieth of additional height. He was aware that each couple of columns made only a single object for the eye; and consequently required in height an augmentation in proportion to what the conjunction of the two gave them apparently in breadth. Again, if we examine which is the most agreeable method of grouping columns, we shall find it to be the same as that in which the date-trees are grouped by the hand of Nature. Nothing can be more delightful than the sight of these trees when forming a long prospect on the banks of a winding stream, arranged two and two, the one projecting, the other placed in the back ground. The eye imagines that it sees a forest of them, and enjoys a view similar to what is presented by

a double circular colonnade, or a peristyle when viewed in its length. This succession of what may be called fraternal couplings forms one of the great charms of the peristyle of the Louvre.

While the date-tree offers to man such a variety of accommodations combined in one source, the other species of palm-trees will be found to afford them to him in detail. In all parts of the torrid zone the cocoa-tree is found to contain milk and oil in its capacious nuts; while the palmetto affords a rich cabbage at its top, and the *latanier* (fan-palm) presents him with fans on the rocks on which it grows by the sea-side. The date-tree appears a native of Africa, and affords to the negroes in its sap a substitute for wine, for vinegar, and even for sugar. In the Asiatic islands the sago-tree contains in its thick trunk an abundant supply of flour; while the areca has an aromatic scent in its nuts. In America the marshy palm-tree of the Oroonoko affords to the inhabitants nourishing fruits during the periodical inundations of that great river, and an asylum in its branches. From the various kinds of palm-trees taken collectively, the supply is so abundant as to afford, to whole tribes, food, clothing, furniture, houses, tools, cables, sails, masts, and boats to navigate from island to island. The number of the ascertained species

of the palm-tree exceeds seventy; and there must be many more with which we are as yet but little acquainted. Although they all belong by common characteristicks to a primitive genus originating in the torrid zone, they differ so much in their flowers and fruit, as to be properly considered as secondary genera. In one point of view they are to be regarded as harmonizing with the various wants of man when in the torrid zone; while, in another, we are to contemplate them as appropriated in their respective varieties to the various animal tribes throughout that part of the world.

Of the various species of this plant, some may be called solar-palms, because, like the date-tree, they grow under the direct influence of the sun, in the midst of the burning sands of Africa. The palms of the mountains partake of what may be called an aërial character, by the length of their pointed tops, which rise above the ordinary elevation of a forest, and sometimes attain even a hundred feet in height. The name of aquatic-palms may be given with propriety to such as grow in fresh-water marshes, as on the banks of the Oroonoko; or in salt-water marshes, as the cocoa-tree; or, finally, on the sea-shore, as the fan-palm and the pandanus. It may be safely taken for granted, that wherever there is a supply of

water between the tropics, whether fresh or salt, stagnant or running, above or below ground, there grows on that spot a species of palm-tree adapted to meet some want of a human inhabitant, and adapted in like manner, by one or other of its varieties, to the support of some species of quadruped, bird, or insect. It is on this account that Nature has given to the animals, such as apes, who are the natural inhabitants of those tracts, strong canine teeth; and to parrots pointed beaks, shaped like pincers, and capable of breaking the nuts of the various species of the palm-tree. Notwithstanding the almost endless variety in the tribes of these animals, it would be no difficult matter to trace a correspondence between them and the various descriptions of palm-trees; so that we may almost say, that there is not a single island in the Indian Ocean which has not its particular palm-tree, as well as its ape and its parrot.

Nature, not content with suspending in the torrid zone her gifts to those magnificent trees, has scattered them in almost equal profusion among the gramina of a humbler class. She has placed sugar in the juice of a reed, and flour in the large ears of maize, as well as in those of rice and millet. She has, at the same time, extended these primitive substances in the tem-

perate zone, among the various kinds of corn, which supply us with food and drink in so great abundance and variety. Barley is found to grow all the way to the borders of the frozen zone; so that the products which constitute the great support of man and of animals are those likewise which are most generally extended.

Not only has Nature provided for us an abundant supply of gramina, flags, palms, reeds, rushes; but she has also stocked us with vegetables of various kinds, the prototypes of which are in like manner to be sought in the torrid zone. In the first rank should be classed the lianas, whose spiral stalks armed with hooks are in perfect harmony with the perpendicular and rough trunks of the palm-trees and other vegetables. A similar harmony exists between the betel and the areca; the pepper-plant and the sugar-cane; the vanilla and the cacao-tree; the water-liana and the mountain-palm, and the wine-liana or vine of our own climate, which winds itself round the elm, and finds a support in its branches.

Other kinds of vegetables come more strictly under the denomination of trees, and are useful in supplying all the wants of man, varied as they are according to the situation which he occupies. The earth may be considered as a vast table, on

which Nature serves up to her guests an endless variety of refreshments. Under the equator she presents them with farinaceous substances in the fruits of the bread-tree, and of the courbari; with refreshing juices in the orange and lemon; with perfumed cream in the jaca (*artocarpus integrifolia*) and the durion (*durio zibethinus;*) with melons in the papaw; with confectionary and conserves in the lit-chi, the mangostan, and the mango; with a dissolving food in the custard-apple; unctuous stimulants in the almonds of the terminalia cattapa; stomachics in coffee and cacao; cordials in the spices of cinnamon, nutmeg, cloves, and of the ravensara, or Madagascar nutmeg, which unites the flavour of all the others.

Of all these trees there is not one which bears a resemblance to any of the others, either in its leaves, its flowers, its fruit, its verdure, or its posture. In this magnificent banquet, the side-boards and the plate are as various as the articles of diet; but I shall point out only some of the least considerable. The variety and magnificence of Nature are equally great in supplying the materials of accommodation in our dwellings. Man finds urns of every size suspended from the calabash-tree; a complete cistern amidst the burning deserts of Africa in the hollow trunk of the boa; a parasol capable of covering a nume-

rous family in the leaf of the talipot; a white and delicate wool, equally fit for a couch and for clothing, in the pods of the cotton-tree; a complete dwelling with rooms of various dimensions under the arcades of the banyan fig-tree; a multitude of wild fruits in these trees, and their various species, adapted to the support of domestic animals; while on the other hand a number of trees and prickly shrubs are made to serve as ramparts to his habitation, and as a protection against wild beasts.

A similar liberality in providing for us and for our wants is apparent, with certain modifications, in the trees of the temperate zone. As Nature adapts her supplies to the course of the seasons, cherries, plums, apricots, peaches, afford us in the burning heats of summer a supply of soft and refreshing fruits; while figs and mulberries give us a stock of such as may be termed saccharine and pectoral. These products are in truth transient like the season which ripens them; but when, like the sun, they forsake us, they are succeeded by others of almost equal attraction. Pears and apples are given to us in the latter part of summer, and when autumn veils the sun with his mists, the chesnut and the verdant oak afford us their mealy and substantial fruit; the olive, the almond, the walnut, produce their savoury

oils; while the vine affords in the fermented juice of its grape the most powerful of cordials. It has been said that spiceries have been preserved in that which is called Winter's bark-tree in the Straits of Magellan; but we can hardly reason in regard to a country so little known, or admit into the list of temperate climates a region ravaged throughout so great a part of the year by snows and tempests. Lastly, the ash, the lime-tree, the willow, the elm, the beech, the oak, and a number of others, all of which have sheltered us against the summer heat by their delightful foliage, now supply us in their branches and solid trunks, with roofs, with materials for the labour of the carpenter, and with fuel against the inclemency of winter.

The gifts suspended by Nature from trees are often deposited on simple herbs, the latter being frequently of a character corresponding with the trees which bear similar fruit, as in the case of the grasses and the palm-tree. Nature may either have destined these products to grow on shallow soils, or she may have meant them as a kind of reserve supply in a situation safe from the injuries of the elements. A great difference subsists between the two in point of time, a tree requiring several years before it begins to yield fruit, and sometimes a period equal to that of

the life of man before attaining its greatest height, while the herbaceous plant arrives at a perfect state in less than a twelvemonth. This difference is particularly sensible when either of them happens to be destroyed by fire or hurricanes, a forest requiring an age to re-place it, while a single spring suffices to renew a meadow. It is probably on this account therefore that Nature has attached to simple roots, below ground, fruits similar to those which she had suspended from the most lofty branches in the region of storms.

Although the species of herbaceous plants are in the temperate zone more numerous than those of trees, we find their prototypes growing in the torrid zone, where the riches of the vegetable as well as of the other kingdoms of Nature appear by preference to take up their abode. We meet with saccharine flour in the bulbous part of the yam and of the potatoe; with spices in ginger; with oily substances in the subterranean capsules of the false pistachia, *(arachis hypagœa)* filled with kernels which prove abundantly savoury when roasted. These substances are likewise found in the aromatic seeds of cardamom and anise; as well as in the mealy and oily seeds of a number of herbs with papilionaceous and cruciform flowers. Blue for dyeing discovers itself in the glaucous colour of the indigo plant; vases may be found in

the gourds; shelter, and materials for dwellings, in a number of plants whose branches run into long twigs; hedges and ramparts in the thorns of the numerous tribes of the nopal, prickly pear, aloes, and melon thistle, which abound so as to constitute forests in Mexico. This thorny genus of vegetables, equally extensive with that of palms, appears by its height to belong to the class of trees, as it is observed to rise to a great elevation, and to continue to vegetate for ages. But as it is unprovided with branches, and has only fibres and a pulpy substance in its stalk, and as moreover it grows only on shallow soils, we place it in the class of herbaceous plants. It may be made however to supply a number of the wants of man; since it gives him a species of fig in the apples of the prickly pear *(cactus opuntia)*; a delightful fruit in the pine-apple, which seems a species of aloes; and fibres of great strength in the leaves of the larger kind of aloes. All these plants are in great abundance in America.

We are enabled to trace several products of the trees of the torrid zone, in the annual and biennial plants of our climate. The taste of the bread-fruit-tree is similar to that of the lower part of an artichoke. The melon of the papaw, and the gourd of the calabash, are found in beds

in our gardens; while the soft and scented pulp of the custard-apple appears in our strawberries, and that of the lee-chee in our raspberries. The aromatic spices may be traced in our sweet gale, our savory, our thyme, and our basils. But who could recapitulate the farinaceous substances in our potatoes, the aphrodisiac in our truffles, the alcaline in our onions, the sweet and pulpy in our carrots and beet-roots, the oily of our rape-seed; and all the various plants which serve as our food, clothing, and lodging, as those of the leguminous kind, along with hemp, flax, madder, and even thistles and nettles. It would appear that the Goddess of Plenty had scattered the contents of her horn throughout our fields and gardens.

The northern regions are better provided with vegetables than we may be apt to imagine from the cold and forbidding character of their climate. I have seen several of our kitchen plants, such as peas and cabbage, growing in Finland beyond the sixty-first degree of latitude. Oats and barley are raised there, and I have even seen cherries growing, and some progress made in the culture of tobacco. A number of our annual plants might succeed there under the shelter of the rocks, and by means of the heat afforded by their reflection. We in return might make acquisitions by the introduction of vegetables be-

longing to that region, such as the cabbage-turnip of Archangel, which, beautifully coloured on the outside with purple and vermillion, is found to have within a taste like our artichoke. Several shrubs and even trees of our mountains thrive in these latitudes; the aromatic juniper reaches there the height of twelve feet; its branches studded with prickly leaves, and its black and azure berries, form a very pleasant contrast to the large foliage and scarlet bunches of the service-tree. Both preserve their fruits throughout the long season of frost and snow, and they afford to man a powerful liquor and cordial, the former in its aromatic seeds, the latter in the juice of its berries. The woods in this latitude are in a manner carpeted with strawberry bushes; we may imagine that we have found the grapes of our own country in the blue and wine-coloured fruit of the bilberry; and our mulberries in the white and purple cloudberry, which creeps along the foot of the rocks in the midst of a foliage of delightful green. If these fruits are less rich than those which they resemble in shape and colour, they surpass them in duration; for though winter buries them under loads of snow they retain their life and freshness throughout that inclement season.

If our fruit trees are found not to thrive in

the north, those which are appropriate to that latitude flourish there with the greatest vigour. The vegetable kingdom may be said to show itself there both in the bloom of youth, and in the stately majesty of advanced years. All the tribes of poplars, of which the birch appears the chief, are found there in contrast with those of the pines and firs, of which the cedar is the prototype. The former, with their broad tops and waving foliage, exhale in summer the perfumes of the rose, and supply saccharine liquors as well as materials for vases, casks, or boats. The latter afford in winter a supply of oily fruits, of flambeaux in their resinous branches, of mattresses in the long moss which hangs from them to the ground, while they present to us a roofy covering under their stately pyramids. If the palm-tree of the torrid zone have a top in the shape of a parasol for the purpose of affording shade, and a bare stalk or trunk to give a free passage to that current of air which is so necessary in a warm climate; the fir has on the other hand branches rising towards their extremities, and sloping their leaves to right and left for the purpose of letting the snow glide off. The lowest firs are twice the height of man, and afford him accordingly a free passage through the forest. But they sometimes grow to the height of a hundred feet, and are

sheltered by ramparts of snow from the piercing blasts of the east and north. The fir of the north, like the palm-tree of the south, is green; but were the former to have a large and tufted top like the latter, it would be borne down by the weight of snow; while on the other hand, had the palm-tree a pyramidal top of leaves like the fir, it would be overset by the rage of the hurricanes, which are so terrible in the torrid zone. There are, it is true, in warm countries, trees of a pyramidal shape, as the terminalia cattapa; and in cold regions, trees of a hemispherical top, like the maritime pine; but the successive stages of the former are very like those of a king in the game of chess, while the top of the pine is open, and consists, at its lower part, only of bare branches in the shape of a parasol. Thus has Nature adapted the foliage and the shape of trees to the climate of their respective growth.

As the nations of the south appear to have found in the palm-tree the first idea of the proportion and ornaments of their architecture, those of the north would find one more suitable to their climate in the fir. While the trunk of the palm suggested the plan of lofty columns of equal diameter, that of the pine affords a model of a diameter progressively decreasing towards the

top, and adding to the appearance of height by the effect of perspective. While the Greek architects adorned the Corinthian capital with palms, and added occasionally imitations of net-work at the bases, and of the nests formed by turtle doves; the architects of the north might, on similar principles, crown their pine column with an imitation of the branches of that tree, clothe it in its natural moss, and pourtray the squirrels, who inhabit it, with their tails raised in the manner of a plume over their heads. If the dove is among the most attractive of birds, the squirrel may be said to hold a similar station among quadrupeds.

The north would consequently have a distinct order of architecture, as it is the proportion of the height of the column to its breadth which forms its constituent characteristic. It would naturally vary the proportions of the column, in each of its diameters, according to the angle laid down by Nature in the progressive diminution of the trunk of the pine. Though I am not acquainted with the ratio of diminution, I am inclined to think it regular throughout. Such an order of architecture I should call conical or pyramidal, in the same way as the four Grecian orders may be termed cylindrical; but let us dwell on the description of objects in preference to the investi-

gation of names, for we shall find Nature extremely rich, and language comparatively confined.

Instead of disposing these columns in long peristyles, like those of the Greeks, in consequence, no doubt, of imitating the position of the fruits of the date-tree, I would group them in conical rotundas, in the order in which the seeds of the pine are arranged in their cones. With this view I would give a progressive elevation to the columns in the middle of the rotunda, so as to increase the extent in perspective, the outside column being shorter and of less diameter. If the peristyle be favourable to coolness in a warm climate by affording free circulation, the conical rotunda is equally favourable to warmth in a cold climate by concentrating it within, and by stopping the course of the wind on the outside. The interior and exterior of its vault would represent the scales and the oval form, which are found so pleasant in the pine cone. On such a slope snow would slide off with ease, and would be in no danger of accumulating, as on the flat roofs of St. Petersburgh, where they have unluckily adopted the southern taste in architecture without considering its unfitness for a cold climate.

The Greeks seem to have been aware of the beauties arising from imitating the proportion and

fruit of the pine, for we find them occasionally adding them to the column imitated from the palm-tree. They reduced the diameter of the latter when arrived at two thirds of its height, for the purpose, no doubt, of increasing its elevation in perspective. They frequently employed an imitation of the pine-cone as an ornamental part of architecture, and particularly on their tombs; giving even an elliptic or conical shape to their rotundas. The Egyptians adopted almost the exact shape of the pine in their pyramids and obelisks. The Chinese, in like manner, have long taken the trunk of the pine as a model for columns in their rich pavilions, while, in their roofs, they imitate a pine branch elevated at the extremities. In their gardens they decorate the entry of their grottoes with this stately evergreen, and they regard it as the symbol of immortality.

It was under the shade of this noble tree, in the midst of its scented atmosphere, and under the gentle rustling of its branches, that I passed, in a solitary part of Finland, days of tranquillity on which I often look back with pleasure and regret. My eyes wandered with delight over the summits of eminences of red granite, covered with verdant moss, and enamelled with mushrooms of various colours. These spontaneous

productions afford a pleasant nourishment to the inhabitants, whose innocence and hospitality are deserving of the greatest admiration. These plants extend northwards far beyond the latitude in which pines are found to flourish; the moss covering the most barren rocks, and appearing even to increase in quantity and variety, the nearer we approach the region of perpetual cold. In the forests of Russia I walked in moss up to the knees; while in the Isle of France I found only lianas creeping in the woods. Lapland affords several species of a mealy saccharine lichen, fit for food; and Nature has placed, in this climate, an animal admirably adapted to aid man in turning such vegetables to account. The rein-deer lives on a species of lichen, and offers to the Laplander, in her four teats, milk of greater consistency than that of the cow; in her hide, a warmer clothing than that of the sheep; and in her running, a degree of swiftness equal or superior to that of a horse. The lakes of Lapland afford, moreover, an abundant supply of fish and of aquatic birds. In the lakes of Finland I have seen surprising numbers of wild ducks and geese. In the season of spring the air is filled with these birds, as well as with woodcocks and swans, who come to take up their summer abode in that climate, and return at the approach of winter to the south.

In that remote latitude, where terrestrial vegetation seems at a stand, we find sea-weeds rising in infinite variety from the bosom of the water. There seems little doubt that even this kind of plant may be made to furnish some subsistence to mankind. The Japanese are said to extract nourishment from the sea-weed of their coasts; and it was in the polar ocean that navigators succeeded in fishing up the *fucus pyriferus*, of more than 200 feet in length. The shores of Greenland, Spitzbergen, and Nova Zembla, are in a manner carpeted with sea-plants; on which the animals, known by the name of sea-horses and sea-lions, are in the habit of resting, as on a couch. These amphibious creatures remind us, by the softness and quantity of their fat, of flagons stored with oil; and afford the Laplander and the Samoyede an ample stock for the consumption of their lamps and hearths. Nothing can exceed the intrepidity of the inhabitants in chasing these animals in the midst of ice and water. It is in this remote region that a simple fisherman, in a small canoe so slight as to be carried on his shoulders, ventures to harpoon an enormous whale, of the length of a ship of war. It is in vain that this monster of the deep shakes, when pursued, the surrounding water with his immense tail and fins. In vain he seeks sh[illegible]er

amidst floating rocks of ice reddened by his blood; the fisherman follows his track, holding him only by a cord, and when at last his strength is exhausted, he drags him to the beach amid the shouts of his countrymen. They find food in his flesh; oil, which to their palate is delicious, in his blubber; clothing in his intestines; and materials for their houses in his massy bones. The Lapland harpooner may be compared in intrepidity to a hero of antiquity, when thus following and pursuing a formidable colossus in the most frightful of climates and of elements.

How much ought we to admire the arrangements of Nature in providing for the largest of animals in a quarter where the vegetable kingdom almost expires, and enclosing under the skin of the whale a supply of almost all that is necessary for the wants of man. It seems as if Nature had decreed that there should not be a spot on the globe where an intelligent being could not find the means of existence. A Greenlander, when brought away from a climate which to us appears frightful, and when introduced as an object of curiosity at a royal court, is found to sigh in the most magnificent chamber after the fields of snow, the mountains of ice, and the aurora borealis of his native country; and if he happens to hear the cries of an infant in the arms

of its mother, he raises his eyes to heaven, bathed in tears at the remembrance of the faithful partner of his cares and her dear progeny. It is clear, therefore, that our attachment is more strongly fixed by moral than by physical ties. In fact our chief enjoyment in the latter is derived from their association with the former. Moral circumstances call up in succession all the harmonies of the different kingdoms of Nature, and their effect is so generally acknowledged, that botanists, when unable to perceive the elementary and animal relations of the vegetable kingdom, have adopted moral relations as appropriate characteristics.

We have already seen what I have called fraternal harmony displayed in almost every vegetable by its foliage, its flower, and its seeds, which are commonly divided into two equal parts, with the view of affording assistance to each other. The same is discoverable in those assemblages of shoots or plants of vegetables which form tufts or thickets. Finally, it is apparent in the various species, or, as we might say without impropriety, the various fraternities of the same genus. There is, moreover, a relation between different genera arising from their discrepancies; and it is the harmony which results from this, that gives such a charm to our land-

scapes. In the torrid zone a great number of trees have a perpendicular trunk without branches till towards the top, with the design, no doubt, that they should not be exposed to the rage of hurricanes. They have, on the other hand, a great variety of climbers, which cover the naked trunks with their foliage. The whole affords a most delightful contrast; leaves, flowers, fruits, all presenting a pleasant dissimilitude. I am induced to think that every kind of tree has its appropriate climber. We have already observed that in India the limber stalk of betel turned in a spiral form around the areca palm; but what is still more remarkable, the leaf of the betel and the nut of the areca produce, by their mixture, a flavour highly prized by the Indians, who are accustomed to chew this mixture continually. The same holds in regard to the sugar cane and the pepper plant, which they often put together, and find the conjunction highly savoury. The blacks in the West Indies make the same use of the chocolate-nut and vanilla.

But on looking around, we find the ground covered in almost every climate with vegetables that maintain a fraternal connexion. In Italy we see this exemplified by the vine and the elm; in our arable fields, by corn and the leguminous plants; in our meadows, by grass and clover; on

the banks of our rivers, by the silver willow and the dark-green alder; in the bosom of the waves, by the perpendicular reeds and the floating-leaved water-lily; in our forests, by the oak and chesnut; in the rocks of the north, by the fir and the birch; and on the rocks of Finland, by the moss and the mushroom. All these, with an infinity of others, form, by their kindred relation, the most agreeable and most useful of vegetable harmonies. Linnæus, as we have already remarked, had a perception of this connexion when he gave the name of *adelphia* to the conjunction of the anthers in flowers; but he should have extended it to flowers themselves, and to a vast range in the kingdoms of Nature. He made only a specific application of a general law; an animadversion which I pass without the slightest wish to deprive him of the merit of the discovery. According to my tenets, the honour of a discovery belongs more to him who perceives in the sea the first projection of an unknown island, than to him who subsequently completes its circumnavigation. As for myself, I profess only to approach the shores in particular spots and in detached directions.

The existence of that which I have called conjugal harmony is still more distinct than the fraternal, and remained equally long unknown. It

is now ascertained that it divides vegetables as well as animals into two great classes, male and female, commonly united indeed in the same individual, and often in the same flower. Apple-trees, peach-trees, vines, leguminous plants, grasses, and a number of others, exhibit in their flowers an example of a perfect union of the sexes. Gourds, chesnut-trees, walnut-trees, offer a division of the sexes on their branches; and the date-tree, the fan-palm, the papaw, and in our climates, the pistachia, hemp, the campion, (*lychnis dioica,*) present, on the other hand, an example of their complete separation on distinct stems, which are frequently very distant from each other. We can easily discover the reason of the two sexes of a vegetable being united in its flower, since, being incapable of loco-motion, they could not approximate each other. In regard to the separation of the sexes on the branches of the same vegetable, and still more in regard to their total insulation, I must confess myself at a loss to comprehend the object of Nature. That there exists a reason, and an important one, for this separation, admits of no doubt. An exception from a general law is often, in the works of Nature, the basis of a new law; but, be this as it may, the impregnation of plants from a distance admits of as little doubt as that of the sexes which

are united within the same petals. Currents of air serve for the purpose of communication in this case, as currents of water do in regard to the spawn of fish: they bear the pollen of the males to the stigmata of the females, and impregnate the germen. In the absence of the zephyrs, less constant, as is well known, than the waves, winged insects, and particularly flies, become the bearers of the fertilizing dust, piercing the nectaria of male flowers, and depositing their acquisition in the bosom of the female. It often happens that the bee acts unconsciously as the medium of these loves. Notwithstanding all this irregularity, the conjugal character of the various kinds of plants remains unchangeable. Sometimes indeed we see a hybrid species result from an irregular conjunction, and we cultivate in our gardens the hybrids of the apricot and peach, and of the apricot and plum; but we never see in our forests the oak, though in the neighbourhood of the chesnut-tree, bear chesnuts; nor the elm, the support of the vines, bear grapes. Linnæus was fully impressed with the extent of the conjugal harmony of vegetables; and he has described its principal characteristics in his system of botany, divided into twenty-four classes. Of these, he distinguishes thirteen classes by the number of stamina or male parts, which he calls *andria*,

from the Greek word *andros*. As examples, we may quote the class of *monandria*, or flowers having only one male; that of *diandria*, or two males; the *triandria*, or three males; *tetrandria*, or four males; all the way to the thirteenth, which he calls *polyandria*, because its flowers contain a great number of stamina. His fourteenth and fifteenth classes are characterized by the term *dynamia*, and come under the conjugal, or under the maternal harmony. His sixteenth, seventeenth, and eighteenth classes are comprised under the *adelphia;* but as he applies this harmony only to an assemblage of stamina, it belongs evidently to what I have called the conjugal harmony. A similar remark is applicable to the nineteenth class, called by him *syngenesia*, the male parts being here joined together; as well as to his twentieth class, called *gynandria*, from the union of the male and female parts. To his twenty-first and twenty-second classes he gives the name of *æcia*, (οἰκια,) and he divides them into *monœcia*, (μονοικια,) and *diœcia*, (διοικια,) because in the first the males are on the same plant with the females, but on a different one in the second. His twenty-third class is called *polygamia*, in consequence of the males and females being coupled in the same flowers, and being found at the same time in distinct flowers; and

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the twenty-fourth class is *cryptogamia*, on account of the concealment of the parts in question. We thus see that Linnæus has referred all his classes, without exception, to the harmony which he calls conjugal, and its various modifications.

The maternal harmony is to be traced in fruits or seeds, and is characteristic of the foresight of Nature for the preservation, the renewal, and the growth of plants. These fruits are covered with chaffs, as in the grains of the gramina; or with capsules, like those of leguminous plants; with a substance like leather, as in the case of the covering of the seeds of apples; with stony shells, as in the case of kernels; with compact fibres, as in cocoa-nuts; with shells of a woody substance, as in walnuts; or with a tough and thorny substance, as in chesnuts. Some are provided with down, or membranous wings, which enable them to traverse the air, and to be committed to the bosom of the earth on every variety of elevation from a molehill to the top of Mount Lebanon. Of this description are the seeds of the dandelion and of the cedar. Others again are contained in a kind of vessel for the purpose of being floated and replanted on the banks of streams and on the sea shore, as is the case in regard to the hazel and cocoa-nut. Some fruits, instead of being shaped like a keel, are rounded, that, in

rolling, they may remove to a distance from the maternal plant, and be enabled to grow in an unoccupied space; as apples and oranges. Most of these relations are however to a certain degree elementary, although established by a Providence evidently attentive to the reproduction of the works of Nature. I might go on to cite other relations of a still more maternal character, such as the cotyledon. This is the nursing leaf of the embryo; the nipple of the young plant. It does not, as in the case of animals, remain fastened to its mother's bosom, but accompanies the fœtus, and goes forth along with it. The gramina and palm-trees have only one cotyledon in their seeds, which are consequently called *monocotyledones;* the seeds of leguminous plants have two, and are called *dicotyledones;* others have several, and are called *polycotyledones;* while others finally have none at all, and go by the name of *acotyledones,* as is the case with mosses, mushrooms, and the whole of the class of *cryptogamia.* We ought perhaps to reckon viviparous aloes under this latter class, and refer them to the mushrooms, as we refer monocotyledonous palm-trees to gramina. Be this as it may, these maternal characteristics of the cotyledons supplied the celebrated Ray, Haller, and Jussieu with the first and principal source of division in

their respective systems. Tournefort deduced other principles of division from the fruits themselves.—We might find out farther maternal harmonies in the protection afforded by plants of a robust character to others which are weak, in situations where, from their disproportion, the fraternal and conjugal harmonies do not exist. Such is the case of the corn and the violet which grows by its side, and seeks its shelter, as if apprehensive of being trodden under foot. A similar remark is applicable to large trees surrounded with small plants, particularly those which are improperly called parasite plants. I have remarked in my "Studies of Nature" that each tree had its particular kind of mushroom. That of the alder, a river tree, bears a resemblance to a shell; the old trunks of the poplar often bear tufts of the *scolopendra;* while the trunks of apple-trees frequently bear the misletoe, with its white fruit resembling silver pearls. Each tree has in like manner its moss; the oak giving a support to the ivy, the honey-suckle, and other plants of a similar character. It is these maternal harmonies between the strong and the weak, the lofty and the humble, that diffuse so many charms throughout our venerable forests.

That which I have called "specific harmony," is the distinctive mark of secondary genera, as

in the case of gramina, where rushes, flags, reeds, palm-trees, come under this description. Each of these secondary genera produces in its turn several species, such as the mountain-rush, which is hollow; and the marsh-rush, which is filled with pith. The gladiole, the iris, the Indian reed, the plantain-tree, the typha, the bamboo, palm-tree, date-tree, cocoa-tree, &c., produce in like manner different species. These species are again divided into primary and secondary varieties.

Each of these genera, as well as each of the species and varieties, admits of being classified in the most exact manner, by appropriating its prototype to one of the wants of man, and its collateral, or secondary kinds, to those of animals; with a subsequent reference to one or other of the harmonies physical or moral. It is in this way that Linnæus classes under the description of *prunus*, or plum-trees not only those properly so called, but peaches, apricots, and, I believe, even cherry-trees. Certain it is, that Jean Jaques Rousseau pointed out to me, at the bottom of the leaves of all these kernel fruits, two small tubercles which serve to characterize them, although differing essentially from each other in colour, shape, smell, and taste. Distinctions can hardly be established, otherwise than by means of the

harmonies which I have pointed out. Moreover, there is no primitive class without a great number of derivative ones scattered in all kinds of situations, from the equator to the poles; for the purpose of meeting the wants of man and of animals. I may therefore be allowed to repeat, that the genus of gramina alone would be sufficient to afford us an ample supply of food and raiment, as well as of the materials of fuel, clothing, and lodging."

Generic harmony in the vegetable kingdom is that kind of harmony which results from the contrasts of primitive genera. The word genus implies a primitive department of creation, comprising a number of species adapted to the various wants of animals, with a prototype calculated to meet one of the principal wants of man. The wants of man arise generally from excess or deficiency in point of constitution. Thus in warm climates our blood is sometimes too much heated, at other times not sufficiently so; and Nature has accordingly supplied, on the one hand, acid and refreshing fruits, as oranges and lemons; and, on the other, fruits of a stimulating tendency, like the saccharine and the aromatic. These juices afford a variety of refreshing drinks; and the vegetables producing them present a contrast equally in point of foliage, of flowers, and pos-

ture of growth. We have already noticed these harmonies of contrast in the palm-tree and the liana; the birch and fir; the grasses and leguminous plants; and even in the mosses and mushrooms of the North. Many other harmonies of the same description have hitherto escaped observation; although the means of noticing them are within our reach. We may lay it down as a rule, that whenever we perceive an unusual sensation of pleasure at the sight of a tuft of different plants, or of a grove of different trees, there exists that generic harmony of which I am speaking. We may farther conclude, that the harmony felt in the contrast of their shapes will, in like manner, be felt on an examination of their products. I mean that, by putting them together, we shall obtain either healthful food, a rich colour, or a pleasant odour. It is thus that the scurvy-grass, with leaves rounded like a spoon; and the red sorrel, with pointed leaves, which grow together on the forbidding shores of Spitsbergen, supply mariners in their mixture with a powerful antiscorbutic. What youthful maiden is not delighted to form in spring a nosegay of lively primroses and dark violets, which grow along the woods in the same tufts! A harmony exists equally in their colour, shape, and smell. May we not suppose that it was of flowers thus

beautifully contrasted, that Glycera made the charming garlands which animated the pencil of her lover, in finishing those paintings which gave him a claim to immortality? Harmonies of this description frequently occur in our meadows, where the undulating quake-grass is confounded with the purple clover; the daisy, the orchis, the livid scabius, and the Adonis, called by this name, perhaps, because its small oval flowers of lively red resemble the drops of blood shed by the beautiful favourite of Venus on the grass. The blue-bottle and the corn-poppy, when together, produce a purple tint in our yellow crops.

Harmonies of this description are found in all directions, on the borders of forests, and along their glades; in the bramble and in the white thorn; in the corneil and the gilded broom; as well as in a multitude of shrubs whose branches are interwoven together. They are seen to decorate ravines, precipices, the borders of streams, rocks, and almost all the asperities of the ground. They seem likewise to point towards the skies, with the lofty trunks of the ash and elm, of the chesnut and wild apple; the poplar and the fir, the beech and the oak. Nothing can be superior to the tranquillity, the beauty, and the magnificence of the spots that are thus adorned. In these retreats we hear only the rustling of the

winds, and the songs of birds; on one side extensive lawns invite the shepherdesses to the dance; on another long avenues and dark porticoes encourage poets, philosophers, and lovers, to indulge in contemplation. Here and there majestic temples of verdure, raised in the progress of ages on moss-covered trunks, overtop the rest of the forest. Each tree has an expression of its own; and each group possesses its concert. A mixed feeling of affection and respect, of pleasure and melancholy, is suggested by the venerable oak to the minds of those, whose lot it has been to know love and misfortune.

These harmonies undergo variation along with those of the sun; and bear a distinct character at dawn, at noon, and at sun-set. They differ still more during the silent clearness of the moon. They are visible even in the darkest nights, when the foliage seems blended with the constellations; and when the branches appear to the eye to lend a support to the stars. Yet these spectacles, magnificent as they are, form the harmonies of only one spot peceived by a single spectator; whereas every spot has its peculiar harmonies, and an endless variety exists throughout the world, both in them, and in the situations which give them birth.

We next come to what I have termed spherical

harmony, by which I endeavour to express the harmonic relations common to genera, species, and varieties. These extend from the equator to the poles; and may be more clearly comprehended by a specific reference to the observations of travellers, than by any attempt at general description. Dampier, and his well-known countryman, Cooke, who followed his footsteps, have given us some of the most enchanting descriptions of this kind, although composed in a manner by chance, on the borders of desert islands. These delineations form, in my opinion, the grand attraction of their respective narratives. Similar observations are to be made in the interior of continents, and wherever art has not too much interfered with the arrangements of nature. Pagès saw in the Mexican territory, in the midst of solitary forests, trees of monstrous size, covered with long grey moss, called Spanish beards, which hung down from the summits of the branches to the ground. They appeared to him to resemple lofty steeples covered with crape, as they stood in groups along the banks of rivers which reflected their venerable shades. He found also, in dry and arid situations, in the same country, the torch-thistle, rising, like an obelisk of flowers and thorns, to more than thirty feet in height, and so extensive as to cover the whole

landscape. Pagès declares, that the grandeur of this sight filled him with pleasure and admiration, and made up at once for all the fatigues of his journey. He had set out on his expedition alone, and almost without funds, with the view of acquiring a knowledge of man in a state of nature. His object was in a great measure gratified; for, among other things, he found families of Indians lodged in the trunks of these immense trees, and accustomed to throw them down by means of a fire kindled at the lower part of the trunk. These inhabitants of the desert had fled from the yoke of the Spaniards, and employed themselves in gathering cochineal on the *cactus* which grew among the torch-thistles. Nothing could be more innocent or candid than their manners; and they discovered the most generous hospitality to this European, notwithstanding the grounds of suspicion that might have existed against him.

It has fallen to my lot likewise to see vegetables of opposite classes grouped together by Nature, and to be impressed, like Pagès, with the magic effect of the association. I have seen the forests of Finland, and of the Isle of France, in their maiden beauty; and I should find it difficult to determine, whether the preference ought to be given to the harmonies of the north or south.

The part of Finland visited by me, when I was engineer in the Russian service, lies to the north of Wyborg, and is known under the names of Finnish Lapland, Carelia, and Savalascia. It extends from sixty to sixty-one and a half degrees of north latitude; while the Isle of France lies in the twenty-second degree of south latitude. Their latitudes differ by the surprising distance of 2,100 leagues; and I may safely affirm, that I never saw a single example of identity in the smallest particle of their vegetation. Every thing is different, down to the soil and the stones on the ground. Finland presents oval rocky eminences, the bald tops of which are surrounded with moss and mushrooms; while the vallies are filled with the birch and fir. Nothing can be more pleasant than the harmony formed by the contrast of these plants and trees. They are visible even in the roads which separate Sweden from Russian Finland; for these roads are so little frequented, and trees grow there so quickly, that we were occasionally obliged to leave our carriages, and to send forward men to clear the road, that we might be enabled to proceed on horseback. On casting our eyes between the dark trunks of the fir and the white birch, we often perceived in the distance a lake with islands; or we heard from afar the noisy cataracts, the

waters of which are precipitated from north to south, as is the case throughout the whole of this country, the ground becoming gradually higher towards the north. Nothing could be more different than the prospect afforded by the Isle of France. I made the circuit of it on foot along the sea-side; proceeding by a path struck out in the middle of a verdant meadow, covered with a species of dog's-grass, the creeping stalks of which are like bundles of packthread, and are terminated by hard and prickly leaves. This kind of grass is admirably fitted to withstand the sea breezes, and forms a spacious border to the island, being interrupted only by groves of fan-palms, which cast a shade around and present a similar resistance to the storm. The woods in the interior of the island begin within a mile of the sea-side. I often walked along their sides, and distinguished groups of benzoins, tatamaques, erythroxylon; of ebony-trees, and a multitude of others, with the names of which I was not acquainted. In the midst of them mountain palm-trees raised their lofty tops, covered with a waving canopy; while climbers, of the length and thickness of cables, spread around a covering of vast carpets of foliage, and, twining to the trunks, defended them against the fury of the hurricane. Streams descending

rapidly from the mountains, opened in different parts of these woods deep avenues, in which their waters are heard to rumble under magnificent arcades of verdure. They afforded moisture to the vegetables along their banks; and, at their influx into the sea, were often obstructed by mangroves shaken by the waves, while the prospect was diversified by spots of verdure thinly scattered along the barren bosom of the rocks. Often have I, seated at the foot of a tree in these vast forests, resigned myself to delightful meditation, and contemplated their branches covered with fruits, fostered by the sea-breeze, and crowded with apes and with birds of various colours. These murmurs of the forests, these cries and songs of joy, told me in a language that could not be mistaken, "This is the work of an all-wise Providence."

Vegetable Harmonies of the Sun and Moon.

If the rays of the sun and moon are refracted by the air and reflected by the earth; if they are thrown back even by the mere walls in our houses and gardens, so as to give considerable additional heat to the atmosphere of towns; there is no doubt that their warmth must be greatly increased by the leaves of vegetables growing in innumerable quantities in our forests and meadows. I have observed indeed, that in April, when our part of the world is covered with these vegetable reflectors, the increase of heat is much greater, than in the months which precede and follow it. This sudden change was no doubt the cause of giving the month its name, (from *aperire* to open); while the epithet of mild is applied to it with particular propriety, when contrasted with the severity of winter. In April an infinite number of leaves come forth from their buds, and reflect the rays of the sun from their surface. We have already observed in the "Studies of Nature," that the trees of the North, such as firs, have their trunks pyramidal, and their leaves varnished; for the sake, no doubt, of increasing this reflecting power; while most trees with horizontal tops, in the torrid

zone, have them turned downwards, for the purpose of lessening the heat. To the former cause I ascribe in some degree the heat of a northern summer, which I found so great in crossing the forests of Russia from Moscow to Petersburg, as to suggest the idea, that, if not absolutely hotter, it was more oppressive than the summer of the torrid zone. I am consequently not surprised that an English naturalist should have thought of proving by thermometrical observations, that the extreme degree of heat was the same under the equator and the polar circles. There is no doubt of its being greater in the north in summer, if we compare the temperature of a spot in a forest of firs, to that of a spot in the open sea under the equator; because the reflecting surface of the fir-leaves presents a much greater extent than the surface of the ocean, in an horizon of similar dimensions. It would be a curious matter to calculate the difference of the two, and to arrive consequently at data for ascertaining their temperature. It is well known that it was by the operation of plane mirrors directed to a single point, that Archimedes succeeded in burning the Roman vessels, one after another, at the siege of Syracuse. It is equally clear, that the excessive heat of Petersburg in summer is not sufficiently accounted for

by the action of the sun, which, in the shortest night, is four hours below the horizon. We are, consequently, obliged to have recourse to some reflecting power; and none appears so likely as that of the foliage of the forests.

The reflection of the ground has, doubtless, an effect of increasing the power of the sun; an island being warmer than the surrounding sea, while a mountainous track is warmer than a plain, and a woody district than one that is bare. To judge from the eye, we should say that a kind of light issues in the midst of the day from the vegetables exposed to the sun; for the tops of the ears of corn, and of the grass of a meadow, have then a luminous appearance. The vegetation of the surrounding plants is naturally accelerated by the reflection thus produced; an ear of corn ripening sooner amongst other ears, than when insulated; and the blue-bottle coming sooner into flower when amidst corn, than when in a garden-border. But the effects of reflected heat are particularly visible in the case of flowers, which are reverberators of the solar rays in all directions. The action of the sun makes them appear larger in proportion than the other parts of the vegetable which support them. On observing a rhododendron, or a rose-tree, in flower, you are apt to imagine that a kind of flame pro-

ceeds from their flowers, the light being perfectly distinguishable from a distance. A certain degree of heat must likewise issue from the flowers of vegetables, shaped as they are, like plane, concave, or parabolical mirrors; and sometimes varnished, as in the case of our buttercups. They are calculated to produce, in a still greater degree than mere leaves, that effect which we look for from our garden-walls.

There perhaps exist flowers modelled on the form of the sun; for we find some in the orchis tribe, similar to a bee in shape, and others similar to the human figure, which botanists have thought proper to call "personated." Why then should there not be flowers resembling, in their inside, that orb of day, which exercises so much influence on them? The asters throw out rays like the stars, from which they derive their name. The daisy, as we have seen, resembles in its disk, surrounded by petals, and covered with florets, one of the hemispheres of the earth, with its equator and vegetable products arranged in a spiral form. It seems not impossible that we might find in a flower that correct model of the sun's shape, which we have hitherto sought in vain from our telescopes. Why should it be absurd to expect to trace there the lineaments of that luminary, when we find in flowers so many

representations of the figures of insects, birds, and of the heads of men and animals? These curious researches belong to the province of botanists, although it must be confessed that these gentlemen have more than once overlooked truths of no difficult discovery.

In treating of the harmonies of the sun with vegetables, we observed that the latter derived almost all their qualities from that luminary; and that the flowers of some of them, being exposed all day long to his rays, became phosphoric during the night; as occurs in the case of the biennial monkshood. We likewise remarked that their different species were to be considered as regulated, partly by reference to solar influence, partly by reference to the wants of man; that it was to the sun that fruits owed in a great measure their colour and taste; and that their woody part might be considered a kind of sponge, imbibing the solar rays during summer, and returning them to us in the shape of fuel to enliven our hearths in winter. We farther remarked that it was to the solar rays that vegetable products owed their phosphoric light, when they fall of themselves into a decomposed state; and that they bear evident marks of solar influence in the layers with which they are invested every twelvemonth. I make this recapitulation of

passive harmony, for the purpose of exhibiting in one view all the harmonies of the vegetable kingdom with the sun; and I shall follow the same course in regard to those which prevail between the vegetable kingdom and the other domains of Nature.

We have likewise shown, in the course of our former observations, that vegetables have a very evident connexion with the moon; the concentric rings on the roots of different plants expressing the number of lunar months of their growth, exactly as the rings of trees express the number of years. I am now going to add a remark, which I have lately made on the luni-solar harmonies of trees. I have observed, in a polished piece of elm-plank, twelve rows of parallel fibres, in each of the parts which composed the longitudinal direction of the annual rings on its trunk. Seven or eight of these fibres were of considerable breadth in the inside part of the tree; while the four or five rows on the outside were much narrower. My conclusion was, that the twelve rows marked the twelve months of each year in the solar ring on the trunk; that the seven or eight of conspicuous breadth had been generated by the moon, in spring, summer, or autumn, when vegetation is active; and that the four or five rows less visibly marked, were the result of

lunar operation in winter. I pledge myself for the accuracy of the observation, and have no doubt that it would be verified, not only on elm cut length-wise, but in the fibres of a variety of other kinds of wood. It proves to my mind, that the lunar influences of each month harmonize with the solar influences of each year; and that they are no less visible in the trunks of trees, than in the roots and bulbous parts of different plants which I have quoted. Such is the case in onions, carrots, beet-roots, &c., in which we trace layers always in a correspondent number to that of the lunar months, during which these vegetables have been in life. Much is it to be wished that similar observations were made on the woods of the torrid zone, where vegetation is active during the whole year. They would probably lead to a discovery, in the annual layers of some classes, of the twelve lunar rows of fibres clearly distinguished from each other. At the same time, it is not impossible that they might exist in situations where it would be difficult to distinguish them, in consequence of being blended with other forms. The annual rings are scarcely perceptible in ebony, the sap wood of which is quite white, and the heart quite black. In the Isle of France I have seen a kind of ebony where the white and black

were mixed, not by rings, but by irregular patches. However the annual rings and their monthly fibres are very distinctly marked in mahogany and rose wood.

The leaves and flowers of vegetables reflect the rays of the moon in the same way as those of the sun. It is under the influence of the former that the marvel of Peru and night-flowering convolvulus of India open their petals after keeping them shut during the day. I experienced one night a very pleasing specimen of the effect of this lunar reflection on vegetables. Some ladies and young persons of my acquaintance accompanied me one day on an excursion to the tomb of Rousseau at Ermenonville. This took place in the month of May. We proceeded in the public carriage for Soissons, and stepped out of it at the distance of ten and a half leagues from Paris, a league beyond Dammartin, being assured that it was only three quarters of a league from thence to Ermenonville. The sun was on the point of setting when we left the stage, and we proceeded by the foot-path through the fields in a westerly direction on the left of the great road. We walked no less than an hour and a half in an extensive cultivated track without meeting any person. By this time it had become quite dark, and we should certainly have

lost our way had we not luckily perceived a light at the bottom of a small valley. This we found to be the lamp which lighted a peasant's cottage, where his wife was giving out milk to five or six children, who were swallowing it with great relish. As we were both hungry and thirsty, we entreated her to give us a share of her family supper. Our young Parisian ladies regaled themselves along with her on coarse bread, on milk, and even on sugar, of which there happened to be an abundant supply. After having refreshed ourselves greatly by this country repast we took leave of our hostess, who was as much gratified by our visit as we by her reception. She gave us as a guide her eldest boy, who, after a walk of half an hour, led us across marshes to the woods of Ermenonville. The moon, almost at the full, was high above the horizon, and shone with the clearest light through an unclouded sky; she shed her rays on the oaks and beeches which bordered the glades of the forest, and gave to their trunks the appearance of the columns of a peristyle. The winding paths, along which we walked in silence, crossed groves adorned with flowers of lilac, privet, and ebony, all resplendent with lustre from above. The young ladies dressed in white walked before us, and alternately appearing and disappearing through the

intervening flowers, brought to our recollection "the happy shades of the Elysian fields." Struck by this solemnity of light and shade, and particularly by their approach to the tomb of Rousseau, our fair companions began to sing. Their sweet voices mingling with the distant notes of the nightingale made me feel that, if there exist harmonies between forests and the light of the orb of night, there exists still more affecting harmonies between our ideas of life and death, between philosophy and our affections.

Vegetable Harmonies of the Atmosphere.

If the vegetable kingdom increases the heat of the sun by reverberation, we are justified in concluding that it exercises an influence on the colours of the atmosphere by the reflection of its verdure. It is to the green hue of the vegetables which in summer cover so large a part of our hemisphere, that I attribute that beautiful emerald tint which in certain situations is perceptible in the firmament towards sun-set. This tint is rarely discoverable in our climates, but it occurs frequently between the tropics where the summer lasts in a manner throughout the year. I am aware that this phænomenon can be accounted for by the mere refraction of the sun's rays in the atmosphere; but, besides the objection that the green hue is not discoverable in our sky in winter, my opinion may be supported by other facts, which appear to demonstrate that even the azure colour of the atmosphere is only a reflection of that of the ocean. The floating masses of ice, which annually descend from the north pole, are announced before their appearance in our horizon by a paleness of the sky during night and day, which is nothing else than the reflection of the snowy crystals of which these masses consist.

This pale light is similar to that of the aurora borealis, the focus of which is in the midst of the ice of our hemisphere, but in which the white is mixed with yellow, red, and green, because the whole takes in the colours of the ferruginous soil, and green forests of pines covering the frozen zone. This account of the variety of colours in our aurora borealis is more probable, as the aurora of the south consists, according to Captain Cook, only of white mixed with blue tints, a circumstance arising, in my opinion, from the ice of the south pole having neither land nor vegetables to diversify its colour, and being surrounded on all sides with a blue ocean. Do we not see that the moon, which we suppose covered in many parts by lofty glaciers, transmits to us in a bluish white the rays of the sun, which in our ferruginous atmosphere are not pale but gilded? Is it not by the reverberation of a ferruginous soil that the planet Mars always reflects on us a red light? Is it not more natural to ascribe these constant colours to the reverberations of the soil, the sea, and the vegetables of the planets already mentioned, than to the variable refractions of the rays of the sun in their atmospheres, the colours of which ought to change every hour according to the difference of their aspect relatively to the sun? As Mars ap-

pears to the earth to be constantly red, it is nowise impossible that the earth may appear to Mars like a jewel shining at the north pole with the colours of the opal; at the south pole with those of the aigue marine, and alternately with those of sapphires and emeralds in the rest of its circumference. However, not to carry our speculations beyond our own atmosphere, I am of opinion that the earth reflects the blue colour of its ocean, along with the verdure of its vegetables in the torrid zone, all the year through, and in our climates in summer only, for the same reason that the two poles reflect an aurora borealis of a different colour, in consequence of their being respectively affected by the colour of the land and water which adjoin them.

It is possible that our atmosphere occasionally reflects landscapes in such a manner as to announce an island to a navigator a considerable time before he can reach it. It is remarkable that such appearances, like the reflection of verdure, are visible only at the horizon, and on the side of the setting sun. I may cite, in this respect, a person in the Isle of France, who was in the habit of discovering in the sky an image of vessels out at sea; and the celebrated Vernet who declared to me that he once observed in the clouds the reflection of the towers and ramparts

of a town at seven leagues distance. I might farther adduce the phænomenon in the Straits of Sicily, known by the name of Fee Morgane. The clouds and vapours of the atmosphere may, in my opinion, reflect the shape and colour of objects on the earth, since they reflect the image of the sun in parhelia in such a manner as to give it a portion of solar heat. Lastly, since the waters of the earth reflect the shape and colour of the clouds, why should not the vapours of the sky reflect in return the azure of the sea, the green and yellow appearance of the earth, in the same way as they are known to reflect the varying colours of the polar ice?

After all, I assert nothing positively, and give this reasoning merely as matter of opinion. The history of Nature is a task hardly commenced, and we need not shrink from the labour of research though we do no more than lay down some preliminary rules. Our posterity will make use of them to extend their knowledge, or will discard them as superfluous. If my authority should prove of little account in future, a partial error will be of slight importance, and at the worst my book can only fall into obscurity: but should my labours prove to be entitled to attention, an error in a physical topic may be indirectly useful in a moral point of view, in as much

as it will teach the propriety of being on our guard even against writers of credit.

If the colours of the atmosphere receive modifications from the vegetable kingdom, the nature even of the atmosphere will be found to experience effects equally conspicuous. Forests serve as ramparts against the winds, and are said to turn them sometimes from their course. A wood planted or cut down may change the temperature of a considerable track of country; but when in spring all the vegetables are covered with leaves, when the grass of the meadow and the corn of the arable field undulate like the waves of the sea, when an ocean of verdure, if I may be allowed the expression, extends over a great part of our hemisphere, and the winds carry its emanations to the surface of the deep, we may then say with confidence that the qualities of the atmosphere acquire a new character. The mephitic air of marshes is changed into pure air, as has been ascertained by some useful and curious experiments; the pure air becomes replete with balsamic qualities, productive of pleasant changes on all who respire it. It is then that the air alone of the country, and particularly of elevated districts, is found capable of curing chronic maladies, and of giving strength to convalescence. It is then that all

animals feel the flame of love; for I attribute the ardour of this passion, conspicuous chiefly in spring, more to the influence of vegetables on the air than even to the action of the sun. A mere increase of heat is not sufficient to account for the change. Birds supposed to be constitutionally amorous, such as the canary bird, and the turtle-dove, pass the winter in warm stoves without giving any signs of this passion, and without even making their nests. But when the sun rekindles the fire of vegetation, when the flowers and scented foliage exhale perfumes in all directions, it is then that the first sparks of life are scattered through the air; that all beings respire them with pleasure, and that they kindle the flame of love in every heart. On the other hand it is at the time when most plants abandon to the winds the spoils of their stalks, that animals are generally found to close their existence, or to set out in quest of vegetable air in a warmer climate. It seems therefore that animals are brought into existence, inspired with love, and finally consigned to die, at correspondent periods with the plants with which they harmonize. Carnivorous animals alone are excepted from this law, since they copulate in winter, the season when so many of the graminivorous class close their days. Man partaking of a mixed character,

living partly on vegetables like the one, and partly on flesh like the other, knows comparatively little distinction throughout the course of the year in regard either to the impressions of love, or the termination of his career of existence.

We have seen, in treating of the aërial harmonies of vegetables, that they were in connexion with the air by their tracheæ; by the stiffness or suppleness of their stalks; by their roots, leaves, tendrils, and even by the auxiliary plants which climb their sides and protect them from the rage of the tempest. We likewise observed, in treating of the vegetable kingdom, that a great proportion of it had a particular adaptation to the air, by the lightness of their seeds, and by the ease with which they are carried through the air for the purpose of being sown on a distant spot. We remarked farther that vegetables not only changed mephitic into pure air, but transformed it into their own substance, as is shown on their being decomposed by means of fermentation or fire. It is thus perfectly clear that they derive their principal nourishment from the air. I have often seen trees, whose roots winded along barren rocks, carry their tufted and verdant heads to a surprising height. It is, no doubt, for the purpose of collecting nourishment from

the atmosphere, that forests raise towards it such a quantity of leaves, which absorb nourishing juices in the same way as the tongue and stomach of animals. This observation suggests a conclusion not a little important in rural economy, namely, that as the trees derive more nourishment from the atmosphere than from the ground, an acre of land planted with trees must yield a great deal more wood at the end of a century, than we obtain from it by means of the cuttings which take place at stated periods of ten or twenty-five years. In support of this notion, I can mention what occurred to myself at Essonne, in the case of an old poplar, of the kind called *peupliers du pays* by the country people, the young branches of which, being as supple as osiers, were made to answer the same purpose, and consequently rendered this tree a preferable object of culture to the brittle poplars of Italy. The tree of which I am speaking, having been planted on the river bank no doubt more than a century before, had had from the beginning its top cut off like a willow, and produced annually a middling sized faggot of small branches of six or seven feet in height. On becoming the proprietor of the tree, I determined to allow it its natural growth, cutting off all the shoots annually except the middle one. In the course of three years

this solitary shoot became a stalk of five inches diameter in the lower part, and fifteen feet in height, bearing long branches, stronger and of greater compass than all that the trunk would have supplied in the same space of time. If it be found that the stalk continues growing with the same vigour, and if the whole poplar increase in a similar proportion from the time of its being planted, there is no doubt that its branches would not only produce at once more faggots than the petty cuttings made annually from its top, but the trunk would likewise give ten times as much wood, for this tree reaches the height of eighty and a hundred feet.

It may therefore be laid down as a rule that, since vegetables extract their chief nourishment from the air by means of their leaves, the greater their height the more will be the nourishment they receive. It is consequently a bad plan to lop our forest trees, inasmuch as we thus deprive ourselves of the advantage resulting from the successive stages of leaves and branches which the tree would have produced when at maturity. Were we to compare the wood obtained every ten years from these partial cuttings, they would, when taken all together, hardly admit of comparison with that of the trunks of lofty trees at

the end of a century. This advantage is clear and decisive without taking into the account the other advantages of forests, the underwood which grows below their shade, the shelter afforded by them against winds, and the fresh state in which they keep our land and rivulets.

Vegetable Harmonies of Water.

In treating of the aquatic harmonies of vegetables, we explained how their leaves performed the office of lungs and tongue, if I may use the expression, in collecting and respiring the moisture of the atmosphere. We mentioned likewise that a number of their fruits were shaped like the keel of a ship, for the purpose of being sown at a distance, after skimming along the surface of rapid waters; and we noticed their roots as calculated to derive nourishment by suction of the water under ground. We shall now see how water, when changed into sap, becomes gradually transformed by the operation of the sun and air into leaves, flowers, fruits, bark, and solid wood. We have shown how harmonic order divides vegetables into a variety of classes, a number of which, as poplars and willows, may be said to belong to the water; others, like cedars and firs, to snow; others, like mushrooms and mosses, to water in a state of evaporation. Some, like pines and oaks, to rain-water; others, like mangroves, to salt-water; and, finally, some to submarine waters, like sea-weed and madrepores, if indeed we be at liberty to class the latter among vegetables.

The vegetable kingdom, after owing a part of its increase to the operation of water, extends in return its influence over that element; changing it in the first instance into wood, which subsequently, by means of decomposition, becomes vegetable earth. It is to the progressive increase of this kind of earth that we are, in my opinion, to attribute the successive diminution of water throughout the surface of the globe; for it is in vallies and deep hollows that we are to look for the beds of rivers which formerly rolled through them, and which are now absorbed in their soil. Like the inhabitants of Egypt, who exist now only in the shape of dormant mummies, the large rivers and arms of the sea, which furrowed various portions of the globe, now lie converted into vegetable earth, at the foot of the rocks which they smoothed and rendered steep by the action of their waters. Where once was a powerful stream, is now to be seen only a straggling rivulet; as the thin hordes of Arabs are seen to wander over the tombs of the populous nations, who, in a former age, constructed gigantic pyramids, and performed so many useful works.

The vegetable kingdom appears, if we may judge from our limited extent of observation, to acquire a progressive increase at the expense of the ocean, and to spread plants in various parts

of its bed. It has thus formed moving sands and large banks at the mouths of rivers, and, in some situations, in the midst of seas, such as the shallows in the Gulph of Mexico, the Bank of Newfoundland, and that of the Needles near the Cape of Good Hope. I have sailed along the Channel, the Mediterranean, the Baltic, the Atlantic, and Indian Ocean, and I have generally observed that the bottom which was struck on sounding, consisted, even when out of sight of land, of an unctuous and greenish mud, evidently generated by vegetables.

I am inclined to think that earthquakes and volcanic fires owe their origin to the dissolution of such sulphureous and bituminous masses, which separate themselves, at the bottom of the waters, from the fiery particles which originally entered into their formation. This subterranean track is covered, in return, by a variety of plants generally unknown to our botanists. At certain seasons they detach themselves from the bottom of the sea in such quantities as to cover the whole strand. I have seen the Atlantic Ocean covered with them for an extent of more than two hundred miles, in the track between America and Africa. There are likewise quantities of these plants a great way to the north, which supply a stock of forage to the cattle in Iceland and the

Orkneys; some afford salt of soda, and all an excellent manure for the ground. The ocean may thus be said to have its meadows below the expanse of waters; and it is the tempest which brings them within the reach, and renders them subservient to the wants, of man.

But what necessity is there for seeking at the bottom of the deep for proofs of the annual increase of its bed by means of the vegetable kingdom? Evidences of a conclusive kind are to be found on shore; Egypt continuing to increase progressively by the alluvial soil deposited by the Nile; and the country of Aigues Mortes by that of the Rhone. The marshes of Holland, of Labrador, and of the vast mouths of the Oronoko and the Amazons, abound with the wrecks of various masses of vegetables calculated to produce these effects. 'An island may be found to rise from a very small beginning, as Cook and Forster witnessed in the midst of the South Sea. They there saw islets formed by an accumulation of cocoa-nuts, on shoals of madrepores; these cocoa-nuts had grown up to palm-trees, and the annual fall of leaves and fruits had formed a progressive addition to the soil at the bottom.

It would be practicable by means of vegetable power, to give back to the bare summits of our mountains the soil of which they have been de-

prived in the progress of ages; and, on the other hand, to dry and render healthful the marshes frequently found at the mouths of rivers. The mountain trees, such as firs, larches, cedars, and the whole species of pines, are well fitted to attract and collect by their foliage the vapours on the atmosphere of mountains, and to form the soil anew by the fall of their fruits and leaves. On the other hand, aquatic plants, such as willows, alders, and poplars, operate by their roots, like so many hydraulic machines. If planted on marshy ground, they would act as so many silent pumps, and would change mephitic into pure air, while the annual deposit from their tops would have the effect of transforming, in course of time, a barren into a fertile soil. Several kinds of trees might be made to serve both purposes at once. It has been ascertained that the evaporation of the foliage of a large oak amounted to many hundred tons yearly, and the moisture which it draws in, when in a high situation, must be equal to that which it sends forth in a valley.

Were water to continue always in the state of ice, it would form a perpetual obstacle to the operation of vegetable power; but in that state of fluidity which it owes to the heat of the sun, it becomes the great vehicle of that power. In a

state of vapour, it has the effect of swelling seeds and making them spring; in the shape of rain, it runs from the leaves of vegetables to their roots; when expanded in a sheet, it reflects their image on its bosom; when in the shape of a running-stream, it serves to transport their fruits to distant spots. The currents of the Indian ocean convey cocoa-nuts and other seeds all the way to the shoals of the South Sea; and it is on the annual emigration of these fruits, that I have fixed the fundamental part of my theory of the motion of the sea. It was in consequence of observing this emigration that I was led to suggest, to seafaring persons, the propriety of attempting to increase the communications of mankind throughout the globe by means of projectiles committed to the deep. In support of these suggestions I can cite the instance of two bottles, one of which, thown into the sea by an Englishman in the bay of Cadiz, was fished up on the coast of Normandy, with a letter addressed to London; the second, committed to the deep at the distance of 120 leagues from the coast of Spain, was thrown ashore at Cape Prior, with a letter to my address. I have understood that a third bottle was thrown some years ago into the sea, 200 leagues to the north of the Isle of France, and was picked up on the coast of that island, where the letter

contained in it is deposited among the public archives.

But why should we not make use of the regular currents of the Atlantic ocean for the purpose of conveying to our shores, which are completely bare of wood, those forests which decay in the north of Europe and America? Why should we not endeavour to execute on a large, what we are now doing daily on a small scale. The Rhine, the Neva, the Seine, are annually loaded with rafts of wood conveyed by these streams along nearly their whole course. I have seen in Holland several families, in complete house-keeping, upon one of these immense rafts which come down the Rhine. Might we not hazard a similar one on the Atlantic in the summer season, when that ocean descends from the north like a tranquil and majestic river? Merchants used formerly to send, at a great expense, a number of carpenters to cut dye-wood in the bay of Campeachy, and to prepare it for exportation and sale. Fishermen encounter a number of dangers in harpooning the whale in the seas of the North. Nay, it is not many years ago since I was told that an English vessel actually fetched a cargo of ice from the bank of Newfoundland, at a time when that article of luxury was scarce in London. Might we not venture to apply a similar spirit

and ardour to cutting trees in North America? proceeding on the plan of cutting the trunks of firs and oaks entire, with the bark on; and fastening them into rafts by means of the long and supple branches of the birch. The rivers would soon carry them to the sea-side, and a few small vessels might, in the summer season, be found capable of towing a ponderous body across the Atlantic. Moveable rafts are perhaps better fitted to resist the shock of the waves than a solid body of carpenter's work. The Russians make very durable floating bridges of this description, on the cataracts in their rivers; for I have crossed on a bridge of this kind the Nislot, when it was agitated like a sea storm.

Vegetable Harmonies of the Earth.

If the power of vegetation is found to reflect and increase the heat of the sun, as well as to operate on the atmosphere and on water, we shall, with equal ease, be able to trace its influence on the solid globe. We have already seen that vegetables are provided with roots of various shapes, some of which are separated like network, and fittest consequently for working their way into the sand; while others, resembling long strings and pivots, insinuate themselves into the solid ground; and a third description, shaped like cupping glasses, stick fast to rocks, and extract nourishment even from them. We have likewise observed that vegetables were adapted, both in genera and species, to a variety of situations; some to mountains exposed to wind, others to mountains adjoining the sea, and others to plains. We have seen that their seeds were proportioned to this difference of situation, some being very light, or provided with what botanists term wings, to rise to high grounds; while others, shaped like a keel, are fitted for conveyance along the surface of water, and for being deposited on a bank. A different class we find to be of a round shape, for the purpose of rolling along the

surface, and of being reproduced at a distance from the parent tree. Finally, we have seen that the vegetable kingdom was in a state of progressive extension by means of new layers of soil in various situations, from the tops of mountains to the bottom of the deep.

We find similar layers in the body of the earth, at more than 200 feet below its surface. Beds of turf and strata of coal penetrate, as is well known, a great way under ground; yet they are generally thought to be nothing but the remains of plants, or the wrecks of ancient forests covered with fossils. There are in Holland tracks of turf under ground composed apparently of plants belonging to a climate like that of India; for the foliage of the palm-tree is occasionally found among them. An immense track of this description extends from the neighbourhood of Amsterdam to that of Maestricht, and has afforded to the curious investigator sea-urchins, and jaw-bones of crocodiles, incrusted in the stone. How are we to account for such phenomena? Are we to suppose that a sudden revolution of the globe buried them in the bosom of the earth, or is it not more likely to proceed from the spiral movement of the ocean along the surface of a portion of the globe? The fossil relics of the animal kingdom are infinitely more numerous

than those of the vegetable, as may be seen on examining the repositories of marble and calcareous stone, formed by the shells and madrepores pounded by the action of the sea, and amalgamated in the course of ages. In contemplating such objects, the mind is led to consider the globe as a vast sarcophagus, and as in a state of progressive augmentation from the relics of its various inhabitants.

But if death be permanent on the earth, life may be said to descend in an uninterrupted current from heaven. Aristotle defined an unorganized material to be, that which is formed by juxtaposition; and organized materials, those which are collected by assimilation. Although the former definition be applicable to the cylinders which surround annually the trunks of trees, it is at the same time true that the second is suitable only to animated bodies. For example, it is likely that a vegetable spark of life, descending from above, may be introduced into the seed contained in the germen, may call it into a state of growth, and augment its size both without and within, until, the plant being arrived at its complete bulk and term of existence, the animating principle return unto the place from whence it came. Could our minds behold the intellectual tenants of the sky, we might perhaps see the

living forms and first models of vegetables descend from it among the dews, the rain, and the storms. Be this as it may, certain it is that every plant leaves a solid and permanent relic on the earth, and that the world annually augments its circumference with the aggregate of these vegetable substances. Were it practicable to bore under the equator a line to the mass of rock which seems to form the interior of the earth, we should find its upper part consisting of vegetable and animal fossils in layers, arranged like the annual layers which surround the trunks of trees.

Vegetable layers must increase faster in the torrid zone, where vegetation lasts the whole year through, than in the temperate, where its duration is limited to six months. These deposits are distributed along the surface of this part of the world by means of rivers, several of which, when they overflow their banks in the rainy season, cover the ground and raise its surface by their alluvial contributions. Such is the case with the river of the Amazons, the Oronoko, the Nile, the Senegal, and indeed with most rivers in the torrid zone, both in Asia and Africa. On the other hand, the sea in the torrid zone experiences an addition to its substratum by means of madrepores, a kind of stony vegetable, endowed with

animal life. We are thus led to conclude that the torrid zone is in a state of progressive increase, and we look for the maintenance of an equilibrium between it and the rest of the world by means of the frozen zones. The northern hemisphere, bearing a greater mass of continent, is supposed to incline five or six days more towards the sun, so that its summer is longer than its winter. We may speculate on the probability that it would remain stationary in this position, did not the southern hemisphere, loaded in its turn with an additional quantity of ice, in consequence of the prolonged absence of the sun, yield to the power of this lever, and approximate itself to the orb of day. Out of the two movements of the frozen zones are formed the annual rotation of the seasons, as well as that motion which affects the poles in the course of ages for the purpose of giving additional scope to the vegetable kingdom.

Our globe is evidently formed for the purpose of bearing vegetable productions. Were its surface too compact, the tender roots of grass would be unable to penetrate it; and were it less adhesive, the large trunks of trees would not find in it a solid hold. Were it completely level, as might have been the consequence of the mere laws of rotation, the power of the wind would be too

great, and the waters would cover a larger surface of it. Were we even to suppose a dry zone raised above it by centrifugal force, vegetable productions would not find a shelter there. If, on the other hand, the earth were not round, if, for example, it were square, it would contain a number of spots placed out of the reach of sunshine; or if, though round, it did not daily revolve on its axis, one of its hemispheres would be too long exposed to darkness and the other to light; if it did not roll obliquely around the sun every year, vegetable productions would have no variety of season; and finally, if the poles did not experience some variation in the course of ages, the ocean, encumbered in the long run by the wrecks of the vegetable kingdom, would be raised to a level with the continents.

It seems extremely probable that the planetary worlds which we discern in the sky are regulated by similar harmonies. The power of vegetation no doubt extends throughout these worlds in the same way as the solar power; and it probably has, as with us, the effect of increasing the extent of the sphere, as well as of producing a gradual alteration on the poles. Vegetation may be called a tree of life, the roots of which may be placed by our imagination in the sun; the stalks in the planets; the branches in their satellites;

while the smallest ramifications may be supposed to extend even to the invisible comets, which traverse the extremities of the solar system.

Harmonies of Vegetables with each other.

We have seen in our previous reasoning that each of the elementary powers was in harmony with itself, as well as with the others; the air preserving an equilibrium of temperature level with air, and water with water. All the parts of the world support each other, like the parts of an arch, by inclining towards a common centre. Each of the three elements makes the round of the twelve physical and moral harmonies by contrasts and coincidences, from which arise a variety of genera and species, in winds, seas, and mountains. The case is the same in regard to the vegetable kingdom.

The conjugal is, no doubt, the most important of its harmonies. It does not divide vegetable products like animals into two great halves of male and female; but it combines in most vegetables the reproductive power, in such a manner as to make it inherent even in their trunks. We have, in another place, considered the stalks of a vegetable as so many distinct

plants united under the same bark. We are inclined to believe these fibres to be male and female, in the vegetables which have the two sexes; and to consider their union as productive of the power which they are well-known to possess, of reproducing themselves from slips cut out. We are inclined to adopt this opinion by the consideration that this reproductive power does not always exist in vegetables where the sexes are separate, as in the case of the date-tree; where, if we take off the top, the trunk perishes without even putting forth a shoot. This notion will receive additional probability, if we take into account that animals, where the sexes are separate, cannot by any means regenerate themselves; while those which come under the description of bi-sexual, such as the earth-worms, are differently circumstanced; their segments becoming complete animals and reproducing themselves, according to the experiments made by Deleuze and Bonnet. It seems then that the flame of life and love is attached to the union of the male and female fibre, like the flame of a lamp to its wick of thread and cotton.

We might find examples in history of the harmony we are treating of being supposed to exist for a time, not only during life, but even after death. The Old Testament informs us, that David, in

the decay of life, sought warmth from a young maiden; and Plutarch relates that the persons employed in the revolting task of consuming by fire dead bodies at Rome, had the singular notion that consumption took place more effectually when the body of a female was added to a pile of males.

There exists a kind of electricity between the male and female fibre throughout the whole domain of nature. It is known that, by means of the junction of the two in most vegetables, the latter are reproduced, not merely by their seeds, but by their stalks, their branches, and even by their leaves. In consequence of this conjugal fecundity, active in all its parts, vegetable products may be said to form an immense chain of net-work, which stretches along the surface of the globe, and extends from species to species, as from genus to genus. Who has not felt on contemplating a forest, or even a meadow, that other laws are active besides those of mere vegetation? On one side the honeysuckle embraces with its garlands of flowers the round and rough trunk of the oak; while, on the other side, a vine sends forth its arms to clasp the branchy elm. Even the grasses of the meadow afford examples of pleasant harmonies among each other; their flowers, so beautifully varie-

gated, being so many conjugal couches. Their feathered seeds, flying along the air, result from what I have termed maternal harmony. The bleakest situations are occupied by what we may call families of grassy plants, which unite in tribes and legions for the purpose of supporting each other against the storm. The different species of vegetables are linked together by coincidences; while their genera are distinguished from each other by contrast. While botany shews us plants in humble pots, Nature exhibits them in vast amphitheatres. It would be in vain, however, to look for the harmonies of a meadow in a few grasses, or for those of a forest in an insulated tree. It is in an assemblage of vegetables that we trace the sentiments of grace, majesty, and immensity, excited by a beautiful landscape. He who has studied plants, particle by particle, is as much a stranger to the extent of vegetable power, as he who should attempt to reason on the properties of tribes and nations from observing a few detached individuals.

The harmonies of vegetables may be made to afford an ample range of gratifying contemplation to man, without reference to the supply of his wants. While the insect seeks with microscopic eye his food on a single leaf, which to him appears a meadow; while the ox enters with

gladness a track of rich pasture; the pleasure of each is evidently confined to the mere gratification of appetite. To man alone it belongs to admire in plants those channels which convey nutritive moisture, and to derive from a train of similar observations a degree of pleasure calculated to increase with the progress of his years. The sight of flowers is pleasant to us when children; and from the time that we can put a foot to the ground, we delight in running along the enamelled meadow. As we grow up, we take pleasure in assorting the jessamine and the rose for the fair object of our affections; or in grouping the ebony and the lilac together for her gratification. A man who happens to be in easy circumstances, and to join to the command of property the information acquired from a perusal of the works of Le Vaillant, Jussieu, and Linnæus, will require frequent supplies of new species and genera. He feels a wish to enrich his garden with the flowers of Asia, and his park with specimens of the forests of America. Great, however, as these pleasures are, it is a gratifying truth, that the satisfaction thus afforded to a rich man is exceeded by the delight which a sympathetic cottager may extract from botanical observations. What can be more gratifying to the early pedestrian, than the landscape which the

dawn lays open by degrees to his view? His eyes rest alternately on the meadow sparkling with dew-drops; on the forests shaken by the winds; on the moss-covered rocks; and even on the trees along the great roads, stripped of their branches, and looking at a distance like towers or gigantic forms. The beauty of the road often interests him more than the business on which he travels; and the landscape more than the inhabitants. It is impressions such as these that endear to us the days of our infancy, and the attractive spots which we traverse in our journeys. The image of them, and the recollection thus excited, are carried with us wherever we go. The sight of the meadow, yellow with butter-cups, bordered with apple-trees, and covered with white flowers and roses, brings to my recollection the springs and the fields of Normandy; brown, purple, and green sea-weed, hanging from white rocks of marl, recall the cliffs of the district of Caux; aloes and carob-trees remind me of the white and barren eminences of Malta; birches with light foliage, mixed with solemn firs, bring to my recollection the tranquil forests of Finland; while palm-trees and rustling bamboos remind me of the Isle of France.

The delight thus produced by vegetable harmony is felt at all times, in all places, and at

every age. It gave additional ardour to those animating and consolatory lessons of philosophy, which were delivered in gardens by Pythagoras, Plato, and Epicurus. It may be said to accompany mankind even to the grave; for many persons, when hastening to their end, talk with delight of the excursions they intend making into the country. Even cruel hearts acknowledge its influence; for Danton, one of the accomplices in the massacres of September, 1792, was heard, when sighing in his dungeon, and in hourly expectation of death, to call aloud, "Ah! could my eyes only behold a tree." Unhappy man! if this sentiment of nature still subsisted in your heart, you were not arrived at the last stage of depravity.

If our globe offers a variety of landscape in each of its horizons, the probability is that the other planets are similarly circumstanced; and that their vegetable products differ more from ours, than those of America from the vegetable products of our hemisphere. Each planet, turning round incessantly on his own axis, must present in its circumference new modifications of vegetable power, drawn forth by its own springs and summers. The different harmonies of vegetation are, no doubt, exhibited there, as with us, both successively and together. The imagi-

nation may delight itself by considering this rich display of animated nature rolling around the sun in celestial and perpetual harmony. From the contemplation of the lesser bodies of the universe, the mind is tempted to turn aside to inquire whether a mass of equal magnificence adorns the globe of the sun. But here we are warned to suspend the inquiry; no human eye is admitted to see, nor could any human tongue convey a description of, a scene so far beyond our limited conceptions.

Vegetable Harmonies of Animals.

We gave, in the beginning of this branch of the subject, a view of the connexion of vegetables with animals, by means of the variety of their species, of which the prototypes are destined to supply the wants of man. We are now to exhibit a sketch of the relations between animals and vegetables by means of the organs of sight, hearing, smell; as well as by those of taste and digestion. In treating subsequently of what I shall term the animal harmony of vegetables, we shall take notice of the elasticity of the grasses which furnish such extensive beds of repose for animals; and of the leafy coverings which afford them shelter in all directions. It may be laid down as a general rule, that the smaller vegetables are appropriated to quadrupeds, and the larger to birds, by that kind of harmony which may be said to link extremes in nature together. It is a rule of the same kind that connects among each other what I have called "general harmonies." It may perhaps be supposed that the vegetable harmonies of animals, of which we are about to treat, ought to be classed under the title of the animal kingdom; but the two kingdoms are not so distinctly separated; they are

found to approximate for the purpose of affording strength and support to each other. Nothing is clearer than that, without the vegetable kingdom, animals would want subsistence; and that, without animal consumers, vegetables would be choked merely by the extent of their propagation. Their union may be said to compose a rich stuff, of which vegetable products form the warp, and animal the woof. At present I confine myself to pointing out the plain side of this garment with its shades, in order to display the skill of its texture; at a future time I am hopeful of being enabled to describe its ornamented part in all its freshness and beauty.

Vegetable products have a variety of relations apparently foreign to the object of vegetation. They carry, in general, many more seeds than are necessary for their reproduction, and a number of their seeds are surrounded by pulps not necessary in the process of budding. Grasses have a softness which makes them able to resist for a length of time the wind, or at least the winter: they would be stronger and more durable if they were of a woody texture. Why, it may be asked, is not a stalk of grass composed of wood like a small tree? Why, among the different kinds of trees, are there some which always continue humble and feeble, like shrubs

and bushes; while others are seen to rise to prodigious heights? Why, in fine, should there be any plants covered with thorns? Nature, which does nothing in vain, seems here to deviate from her wise course, and to give herself up to caprice and excess; but an attentive examination will satisfy us that these apparent superfluities are admirable precautions, and connecting links in the chain of her power. Vegetable products are intended for the use of animals who require not merely food and a couch, but shades and defence of various kinds.

The difference of colour between fruit and the surrounding leaves may be accounted for by supposing it the intention of Nature to point out to an animal at a distance such fruit as has become ripe. Every kind of vegetable indeed has its tint, which invites the animal for whose use it is intended, to approach it; and which, in general, affords a pleasant contrast to the plant itself. We thus see the black-birds fly whistling towards the red cherries; and the bull quicken his slow steps on beholding meadows in flower. Even the night is not destitute of indications to animals in search of food. The sound caused by various kinds of ripe fruit, when falling, comes under this description; and in America the noise of the ripe pods of the cassia

attracts birds who could not see them from a distance. The fruit of the genipa, which in falling makes a report somewhat like that of a pistol-shot, invites, in the middle of the darkest night, the crabs who travel only at that time; and the fall of mast and acorns attract the boars, as is well known, to the spots where beeches and oaks are situated.

But the great source of attraction of animals towards plants is in the smell. It is by this sense chiefly that they are enabled to distinguish the food that is proper for them, for it is undoubted that they always smell what they wish to eat. This delicate sense precedes the sense of taste, and is accordingly placed by Nature immediately above it. It deserves to be noticed that the organs of sight, hearing, smell, and taste, are all arranged in the head in the same order as the elements on the globe; namely, as light, air, aquatic vapour, and the ground. We may also be permitted to observe that these senses, like the elements with which they correspond, exhibit a scale descending in point of extent, and ascending in point of enjoyment. Sight extends to the greatest distance, but takes in only the surface of bodies, while our organs of taste, guided by our smell, penetrate the inside. Nature, impartial in all her gifts, has given only a feeble sense

of smell to birds; while she has bestowed on them a piercing eye, and the power of choosing lofty situations for the purpose of giving range to the compass of their observation. Quadrupeds on the other hand, destined to live on the ground and among vegetables, have a confined view, but an exquisite sense of smell. A graminivorous bird judges of its nourishment generally by its look and colour. A fowl does not smell the grains laid before it, but if they are unknown to it, it spreads them out with its feet and beak, and looks at them on every side before swallowing them; a circumstance which is probably the cause of its not eating during the night. A horse, on the contrary, feeds in the dark as well as in the light, but on receiving his oats he never fails to smell them, and to abstain from them if the odour be offensive. The cat, like all carnivorous animals, has a very keen sense of smell, because the night is the chief season for hunting out its prey. It does not even take food directly from the hands of the giver, dreading apparently to confound the smell of the two; so that the food must in the first place be laid on the ground that the animal may smell it in a separate state, and decide how far it is likely to agree with its stomach.

But it is the sense of taste which finally gives

animals a certainty of their food being adapted to their constitution. This is evinced by the ejection of saliva from the nervous papillæ, an ejection which takes place only on the food being found suitable, and which operates powerfully in aid of digestion. Before entering on an analysis of this subject, it is proper to observe that it is for the purpose of gratifying this sense, so various in different animals, that vegetables possess such a variety of taste, and are marked, if I may be allowed the expression, by all the modifications of which nourishment is susceptible. Most plants are distinguished to the eye only by shades of verdure; but they all differ in point of smell, and particularly in that variety of taste which is decisive of their virtue. I cannot help thinking it singular that botanists should hitherto have had recourse to the sense of sight only, and should have studied merely the apparent characteristics of vegetables which are often variable, while the sense of taste would have pointed out a number of characteristics decisive of the nature of plants. A systematic student with the best magnifier sees only one kind of plum in all sorts of plum-trees; but a child, though blind, would have no difficulty in distinguishing different sorts by the taste.

Moreover, all our elementary senses will be found to point to the sense of taste; for if sight,

hearing, and smell, give animals notice of their food, motion is necessary to bring them in contact with it. Now the walk and motion of quadrupeds has a character adapted to the grass which forms their pasture, as well as to the earth on which they tread; the length of their necks being evidently intended to aid them in inclining their mouths to the ground. Birds that feed on fruit have a manner of flying adapted not merely to a passage through the air, but to landing on the trees from which they extract their nourishment. With this view they are provided with short feet, having three claws before and one behind to catch hold of the branches. Those birds which like the ostrich find their food on the ground, and do not fly from spot to spot, have no claws or toes in the hinder part of the foot. It is curious to see in the case of insects still more ingenious means of moving and adhering to the ground, the smallness of their frame exposing them to be carried off by the wind. The ant, with its six legs armed with hooks, climbs to the top of the highest cypress to get hold of the fruit. The caterpillar scrambles by the aid of twelve rings, armed with little claws, along the trunks of trees, and finds means to get a firm hold of their moveable leaves. The torpid snail attains the same object by the glutinous nature of its mem-

brane. The grasshopper skips over the grass of the meadow by the spring of its long legs; while the cochineal insect, feeble and sedentary, creeps, on coming out of its egg, from one nopal to another by means of threads wove by spiders like so many bridges of communication. It next fixes itself for its whole term of life on a thick leaf, into which it pushes its brittle trunk. It is, no doubt, for the purpose of protecting it against birds, that Nature has covered this vegetable with points sharp as needles, a prickly coating rendering the smallest plant as inaccessible to the feathered species as the elevation of the cedar makes it to quadrupeds.

If from birds and beasts we direct our attention to fishes, we shall find that their mode of swimming has a connexion with their manner of obtaining a supply of food from vegetable products, or from the dissolution of these products in the water. Fish abound at the mouths of rivers in consequence of the large supplies of vegetable matter which are there to be found; some being fitted by the length of their shape to pass between the narrow straits of rocks, such as the whiting, eels, lampreys; others like plaice, brets, and flounders, being flattened for the purpose of moving along the sands; while a farther description, armed like whales with a broad tail, pro-

ceed in winter to the extremities of the northern ocean, and find food in the bays where currents coming from the south are supposed to deposit alluvial soil. They there rest their vast bodies on tracks covered with marine insects which they crush and devour; and they are enabled to resist the shock of floating masses of ice in summer by means of the thick covering of fat with which a plentiful supply of food has cased them.

It was fit that Nature should give to each class of animals a different mode of movement, since she has placed the food of each in different situations. It is scattered at the summit of the mountains and bottom of vallies; under the surface of the earth, and in the depth of waters, on roots, mosses, grass, and trees. Moreover, each vegetable will be found to afford nourishment in its several parts to animals of different classes. With its sap it supports microscopic animals; with its leaves gnats and gall insects; with its flowers the fly and the butterfly; birds with its seed; quadrupeds with its stalk; ants with its dead trunk; and finally, even fish with what may be called its decomposed parts. If to this list of animals living on plants, we join the list of carnivorous animals who prey upon the former, and who are perhaps equally numerous, whether we view them as insects, birds, quadrupeds, or fishes, we shall

find that the smallest plant is the centre of a living circle of animals. The most insignificant moss may thus yield support to an insect fixed amidst its stalks, to a quadruped when it is consumed along with a quantity of other moss; and to a fish of the whale species after it has undergone decomposition. Such is, no doubt, the progressive use of the moss appropriated in the north to the food of the rein-deer. It gives a refuge to the terrible gad-fly which torments that animal, but which, when driven by the wind into the sea, probably becomes itself a prey to the whale. As every harmony of an element with the sun gives a character to a variety of vegetable products, it may be said on the other hand that every harmony of a vegetable with the sun stamps a character on various species of animals. On comparing the relative numbers of vegetables and animals, we shall find that the latter greatly exceed the former, for I have heard it asserted that there are no less than five or six thousand kinds of flies in France, and not two thousand kinds of vegetable products.

No animal is without those organs which are necessary to its particular mode of living; and none have more than they require. Aquatic birds, such as ducks, geese, and swans, which waddle in the mud of rivers in quest of roots or worms,

have large flat beaks; while other birds accustomed to feed on soft roots, as the starling and black-bird, have a long and pointed beak. In graminivorous birds, such as canary-birds and goldfinches, the beak is short, broad at the bottom, somewhat arched and sharp at the sides for the purpose of breaking grains; while in birds who, like the parrots, live on seeds confined within hard shells, the beak is sharp and crooked like the teeth of pincers.

It is not unworthy of notice that the number five, which forms the first division, properly so called, of the circle, is employed in the five petals of rose-shaped flowers, which we are in the habit of planting by preference on account of their attracting in their focus the largest share of the solar rays. The human hand is divided into a thumb and four fingers, as affording the most convenient means of grasping an object; and it is curious enough that the same number exists in the organ of touch in birds. It is true that those who do not perch have only three toes on each foot, while those who do perch have four; but as both are in the habit of getting hold of their food with their claws and beak, we may follow up the analogy by reckoning the beak the fifth member; considering it as divided into two in the birds with three toes, and as single in those

which have four. This computation is supported by the circumstance that the beak of birds is composed of a horny substance similar to their claws, and that it is not only of the same colour, but of similar proportions in shape and length. Both are hooked in birds of prey, broad and flat in geese, long in woodcocks, and short in sparrows. We may therefore say that the toes of birds are little else than a hand, and that their beak may be called the thumb. A similar division is found in the case of crabs, whose voracity is so well known, Father Dutertre having very properly compared their eight toes and two claws to two walking hands placed back and back.

Quadrupeds accustomed to live on grass have thick lips for the purpose of catching hold of their food, and a double row of teeth to grind it. Some, like the ox and goat, have only a single row of teeth for the purpose of cutting the grass, but they have a double stomach for enabling them to chew a second time such food as has been imperfectly bruised. Who can undertake to enumerate and describe the organs of taste in insects? Some have a kind of auger or borer, like the wood-worm known in France by the name of *taret (teredo navalis);* others have quadruple jaw-bones, which act at once on right and left as well as above and below, like those

of the locust. Insects have likewise graters, planes, pumps, dissolvents, suckers, scissars, chisels, files, gravers, which enable them to extract their food from all parts of vegetables. Let us no longer vaunt the ingenuity of Dædalus, who invented a saw for the purpose of making the knotty trunks of trees into planks, since insects, with instruments comparatively so feeble, are able to reduce them to dust.

Lastly, animals restore, by means of their sulphureted excrements, fertility to the plants which they consume, and it is believed that they often sow anew grains that have passed through their stomach. If the bush gives a bird a fortified retreat in its thorny branches, and food in its hard berries, the bird in return drops to the ground as seed that part of the berry that is indigestible. Such are the wondrous ways of Nature in maintaining a harmony between her different kingdoms.

Even our roads are covered with plants of a nature so suitable to most of our domestic animals, as to be used for the purpose of rearing, fattening, or curing them. The knot-grass, which extends its adhesive strings along the beaten path, and may be said to grow under the passenger's foot, is highly acceptable to the hogs, who seem to take a pleasure in searching for the

means of support along the public way; preferring this plant to grass, and even to corn. It is on account of this preference that the country people in France call the knot-grass the hog's food. Cattle are likewise fond of it, and I have seen it form a very good pasturage on dry and barren slopes. The nettle which grows so vigorously along the walls of farm-buildings is so acceptable to turkeys, that, when cut in pieces, it proves the best food that can be given to their chickens. The silver weed, (*potentilla anserina*,) so much run after by ducks and geese, is seen covering with its yellow flowers the banks of the marshy tracts where these birds take a pleasure in waddling. Even the thistle, which grows on the most neglected spots, is the favourite food of the solitary ass. The cat-mint, which grows spontaneously in our gardens, attracts at night, by its strong scent of mint, the cats of the neighbourhood, who roll over it and eat it with extreme relish. Dog's-grass, so called because dogs eat it as a purgative, grows in all directions; goats browse on it with pleasure, and the quality of their fleece is said to be improved by it. It is not to the atmosphere of Angora that we are to attribute the fineness, the length, and the gloss of the goat's hair, of which the Turks make their magnificent camlets; nor to its rocks, which,

notwithstanding my supposition in the "Studies of Nature," have no existence; but to the long and silky dog's-grass produced throughout its vast plains. I owe this observation to Busbeck, the well-known traveller, to whom Europe is indebted for the lilac imported from the east, and whose authority is deserving of particular attention.

The plants which, from their general utility and extended growth, are called cosmopolite, will be generally found by the side of highways, and may be considered as a kind of provision made by Nature for tame animals on a journey. The vegetable and animal kingdoms seem to preserve their equilibrium by a kind of flux and reflux; it appears likely that animals feeding by the road-side are instrumental in depositing in the ground, as seed, those grains which are found indigestible in their stomachs; while, on the other hand, by cropping the grass, they prevent any excess of growth. The female flower opens its petals to the insect, which impregnates it with the powder of a male flower. The grass becomes a tuft for the mouth of the quadruped; who, as we have just observed, commits again to the earth its grains, after they have passed through his stomach. The tree, planted in the same manner by the bird, spreads its branches to open to him a refuge; but the insect in return

deposits a canker-worm in the bosom of the flower. The quadruped not only crops the meadow and prevents it from seeding, but causes vacancies in the forest by browsing on the lower branches; finally, the bird consumes the superfluous seed of the trees. A singular example of the maintenance of this equilibrium between the animal and vegetable kingdoms is to be found in the following circumstance: All men of letters are acquainted with the beautiful description of the Island of Tinian, given by Admiral Anson's Chaplain. This exact and elegant writer exhibits the forests of that island as containing extensive glades, in which numerous herds of white cattle were at pasture; and as crossed by rivulets, which, descending from distant mountains, fall into the sea, after watering plains covered with a multitude of fowls and pigeons, which made the air resound with their noise. In short, he represents this solitary island as a rich farm in the midst of the Southern Ocean. On the other hand, subsequent travellers entitled to attention, such as Captain Marchand, treat this description as fabulous, having found in Tinian only an impenetrable forest and clayey marshes, without cattle or fowls. It is, however, no difficult matter to reconcile the two; for when Anson landed at Tinian, the island was covered with wild cattle

which cropped the lower branches, as well as the stalks of grass, and thus kept glades and avenues open in the forests. Intermediate navigators, and particularly the Spaniards of the neighbouring islands, destroyed these animals by continuing those hunting parties which were beginning to become frequent so early as the days of Lord Anson. The consequence was that trees shot up in all quarters; the grass, from not being cropped, obstructed the course of the rivulets; while the beautiful glades and meadows disappeared. An instructive example this of the manner in which the beasts of pasture repress the luxuriance of the vegetable kingdom;—in fact they may be called the first gardeners of the earth, in as much as they unconsciously fertilize and embellish it; but their vegetable harmonies will not be found, after all, to stand comparison with those of man.

Vegetable Harmonies of Man.

We have shown, in our first observations on the vegetable kingdom, that the different genera of plants are adapted to the constitution of man, and to his principal wants in different latitudes, in an inverse ratio to the influence of the sun. We shall now explain more in detail the vegetable harmonies of man, and join to them what may be termed the human harmonies of vegetables, for the sake of combining the whole in one description. In this inquiry we shall see a display of the active and passive relations of vegetables with all the senses of man, and particularly with that nourishment of the human species which forms one of their principal uses.

Who can contemplate without emotion the harmonies existing between vegetables and the elements with reference to a supply of the wants of man? How delightful the effect of morning on the flowers of the meadows and the leaves of the forest! The latter may be said to resemble immense vaults of verdure supported by columns of ancient bronze. When the sun, in the midst of his career, warms the fields with vertical heat, trees afford us magnificent parasols of that colour, which, as is well known, is most suitable to our optic nerves. Green may be called an harmonic colour, formed of the yellow of the earth and the

blue of the sky. Nature has covered with it the plains, the valleys, the mountains, and the plants. Even night, notwithstanding her darkness, shows us fresh sources of harmony in the vegetable kingdom. The moon enlightens the forests with her trembling rays to guide the steps of the traveller; the stars in the east are visible by turns at the extremity of the branches, and appear to crown the tops of the trees, so as to make the traveller imagine for the moment that they support constellations.

The blessings of light are common to animals as to men; the rising of the sun being an awakening call to all nature, while the rising of a star may serve as a notice to a bird of night or to an insect, as well as to men employed in stations of vigilance. But one of the chief benefits peculiar to man consists in the enjoyment of the warmth derived from the consumption of fuel. When night covers the horizon with her veil, the fisherman kindles his torch, and the artisan lights his lamp; buildings are illuminated throughout their different parts, and a city appears, from a distance, resplendent like a constellation. In as far as light is concerned, several insects may be considered on a level with man, for various worms possess, as is well known, a light of their own; but fire must be deemed to have been highly instrumental in giving to man the empire of the

earth. It is for the purpose of keeping it up throughout the rudest winters, that Providence has covered the northern regions with resinous trees, such as pines and firs, which are evidently intended for the wants of man, and not of animals. The mere sight of fire frightens the bear or the fox, as well as the other tenants of the northern forests, while it rejoices the heart of the Laplander and the Samoiede.

The experiments of the celebrated Ingenhouz, and of other naturalists, show that vegetables renew the atmosphere by changing the mephitic air of marshes into pure air. This advantage is of course enjoyed by animals as well as by man; but a variety of other advantages are peculiar to the latter. Trees afford him the means of sheltering himself from the suffocating effects of a stagnant atmosphere, or of burning winds. They supply him in warm climates with fans, like the leaves of that kind of palm-tree which thence derives its name, and the shape of which may be seen on the painted papers of the Chinese, who are in the habit of making frequent use of them. While the branches of trees afford him parasols and ventilators, their extensive groves present him with ramparts against the fury of hurricanes. By the aid of fire and machinery, he is enabled to fashion the wood of the forest into poles, palisadoes, and enormous beams, as well as to con-

struct a roof which serves as a permanent covering for himself and family. Plants, such as flax, hemp, and the cotton-tree, supply him with cloth, fitted, by its lightness and suppleness, to protect his body from all the inclemency of the atmosphere. By means of sails made of the stoutest kind of such materials, he makes the winds subservient to his use; deriving a substantial accommodation from that, which, in the primitive days of society, had merely been rendered a vehicle for the expression of sentiment through the medium of flutes and hautboys.

Forests attract the vapours of the atmosphere to the tops of mountains, and thus procure a supply to the springs which form the sources of rivers. There are likewise several kinds of vegetables apparently destined to be reservoirs of that rain-water which is intended to refresh dry and barren spots. In our climates, the axillæ of the leaves of teasel (*Dipsacus Fullonum*) contain the quantity of a small glass-full of rain-water; while the leaf of an American species of Indian reed holds a large cup-full. A parasitic plant, like the head of an artichoke, which grows on the pines of the bay of Campeachy, is said to hold a large pint of water; the water climber of the Antilles, when cut, runs like a fountain; and the boa of the sandy shores of Africa is a vegetable cistern, being found to contain in its hollow trunk as much as

would fill several barrels. In these respects, however, the foresight of Nature seems directed to the accommodation of animals as well as of man; but the case is different in regard to the power of floating trees, which seems useful to man only. Although wood is frequently as solid as stone, and in some cases as hard as iron, it is almost always lighter than water. Without the means of making wood available in this manner, the ocean would have remained unnavigated, and its islands would have been without inhabitants. It deserves to be remarked that the vegetable products which, from their lightness, are the fittest for this purpose, are found growing on the banks of rivers. Such are the bamboos of India, the willows and poplars of our climates, and the birch-trees of the north. Although their stalks are tender and hollow, and although the weight on their tops is considerable, they are enabled, by their elasticity, to resist the effects of those tempests which would burst asunder pillars of stone of equal height and diameter. In the case of trunks of greater hardness, man has derived the most essential assistance from fire in the processes of excavating and in giving a shape to those untractable materials; he is thus enabled to make them into casks or canoes. It was with canoes that he first found means to people islands, and to commence that course of navigation which

put it eventually in his power to circumnavigate the globe.

The power of vegetation covers the earth with trees, grass, and moss, which serve for the double purpose of covering and litter to animals and to man. The same power covers even the perpendicular sides of rocks with ivy, vines, and bushes; and presents thus so many steps of ascent to quadrupeds as well as to men. But man alone is enabled to vary at his will the landscapes of the horizon, by means of agricultural improvement; and particularly by the application of fire. To contemplate the progress of a rising colony in a newly discovered island is a spectacle worthy of a philosopher; for it is there that the culture of man forms a striking contrast with that of nature. That contrast was frequently brought before my eyes, in the pedestrian journey which I made in 1770, along the circumference of the Isle of France. Sometimes, in passing along the sea-shore, on a green meadow interspersed with fan-palms, I traversed gloomy forests of benzoin-trees, olives, ebony, and tatamaques. At other times, I entered on spots lately brought into cultivation, where monstrous trunks of those trees, overturned by the axe and sometimes by gunpowder, lay along the ground; and being in a course of consumption by fire, were throwing out volumes of smoke. In some places their

ashes still gave an evidence of their shape and size; but in all directions they covered the soil to the height of at least half a foot; and laid, by the additional salts which they contained, the foundation of a long and abundant fertility. On neighbouring lands, that had been some time longer cleared, I frequently saw the spots brought into cultivation around a dwelling covered with rising verdure. On one side, I beheld a mountain raising aloft its rustling forest, and pronouncing itself the work of Nature, clothed in vegetables for the use of the animals of the island. On a different side, I beheld other mountains, which, in consequence of having their trees cut down, had lost a portion of their elevation; but were covered with fields of coffee-trees, sugar-canes, maniocs, and yams, divided by hedges of roses and pine-apples, and proclaiming themselves the object of human labour.

We are enabled to trace the arrangements of Providence even in a point apparently so minute as that of the means of scaling the sides of trees. Were botanists correct in imagining that trees grow merely by the effects of attraction, or of a column of vertical air, their trunks would be as bare as a stalk of corn. In their natural state, however, the quadrupeds who live on fruits, such as squirrels, monkies, and rats, reach the summit by merely taking hold of the bark with

their nails; while to man, the branch affords additional facility, either in gathering the fruits, or in attaining the top for any other purpose. The palm-trees would be difficult of ascent on account of their great height, were not their trunks covered with notches formed by the successive fall of their palms. It is, no doubt, with a view to the accommodation of man, that lianas are so common in the torrid zone; and that they turn in a spiral form all around the trunks of those trees which are in general without branches at their tops. I have likewise observed, in those climates, that the vegetables, which produce soft or bulky fruits, generally bear them on their trunk and within the reach of our hands; such are the plantains, papaws, bread-fruit, and even calabashes. In the same way the fruit-trees in our orchards; such as apple-trees, pear-trees, peach-trees, and apricots, are surrounded by a green sward, and do not rise above a middling height, presenting to us both the fruit and an easy means of gathering it.

The assistance derived from the application of fire enables man to accomplish very important alterations in regard to the vegetable kingdom. We can thus consume a variety of things which are useless; but which, without this auxiliary, would lie for a long time encumbering the

ground. Fire enables us to improve and prepare for food a number of vegetable products, which of themselves are repulsive or insipid. Coffee is rendered palatable by roasting; tea by infusion; tobacco by fumigation; and leguminous fruits by boiling. The mind is little accustomed to analyze the operation of an agent so familiar to us as fire; but the more it engages our attention, the more we shall discover that it performs an important part both in agricultural processes, and in the various arts derived from them.

Man finds an opportunity of taming a variety of animals by means of the vegetable products of which they are fond. It is by the aid of grass, trefoil, barley, and vetches, that we attach to our habitations the cow, the ass, the horse, the goat, and even birds, such as fowls and pigeons, which, from their power of flying from us, might seem destined to perpetual liberty. Vegetable products likewise furnish us with weapons to repulse the carnivorous animals. Never was the monkey, the inhabitant of the forest, seen to take up arms to fight his enemies; but man, by the application of intellect and the command of fire, is enabled to cut the knotty root of a tree, and shape it into a club; to bend its branch into a bow, and to make a quiver of its bark; while the smaller plants are fashioned

into arrows, and the taller into lances. These arms, the gift of the vegetable kingdom, enable him to vanquish even the lion and tiger; happy, could we say that we had never exerted our powers to make those arms subservient to the destruction of our fellow creatures.

If Nature has put the vegetable support of domestic animals at the disposal of man, she has likewise placed man himself in direct connexion with a number of elementary plants. Man is stationed in the centre of the vegetable world by his size and attitude; for an erect posture is given him, not, as poets have imagined, to contemplate the heaven, but to take a comprehensive view of the vegetable treasures of the earth. We may calculate that there are nearly as many of these products above as below our heads; so that our stature is adapted to the purpose of giving us a view of either. The birds that live in trees easily turn back their heads to take a view of the food that is above them; while quadrupeds, for a correspondent reason, carry their heads inclined to the ground. We, on the other hand, have an equal facility in looking upward or downward, to right or left, according as we wish to fix our eyes on the grass at our feet, or on the tops of the loftiest trees.

These remarks are particularly applicable in

the case of fruit-trees. Fruits are generally suspended within our reach, proportioned to the grasp of our hand, and not unfrequently fashioned, as we may say, for our mouths. They almost always gratify the sense of smell, and generally our sense of sight. In one of La Fontaine's fables, a peasant of the name of Garo regrets that the pumpkin should not be borne by the oak:

> C'eût été justement l'affaire:
> Tel fruit, tel arbre, pour bien faire.

The speculative countryman, having fallen asleep at the bottom of the oak, an acorn falls on his nose. He is suddenly awakened, and exclaims,

> Oh, Oh! dit-il, je saigne; et que seroit-ce donc
> S'il fût tombé de l'arbre un masse plus lourde,
> Et que ce gland eût été gourde?

He now draws the sagacious conclusion that every thing is in its place; and he gives thanks to Providence for suspending a small fruit from a high tree.

Nothing could be better than the moral of this fable, were not the manner of expressing it calculated in some measure to lead young minds

into error. A child on getting this fable by heart, is induced to imagine that large trees do not bear heavy fruit; a notion which may take deep root, as first ideas are apt to make a very strong impression. What is he then likely to think on hearing that there are in India palm-trees of the height of sixty feet, whose tops are crowned with cocoa nuts of thirty pounds weight? The error of La Fontaine lies in mis-stating the intention of Providence, which is not to give trees as a shade for those who choose to recline under them, but for the purpose of bearing productive fruits. In every kind of vegetable there seems a class reserved for man, and entitled to the name of models, or prototypes of the genus. Their fruits when tender are of small size, and little elevated that they may not be broken in their fall. Others which are tender and of considerable size, such as the bread-fruit and durion *(durio zibethinus,)* grow at the ordinary height of man, on the trunk of the tree that bears them. The heavy gourds of the calabash are suspended at the distance of four or five feet along its thick and long branches, which bend down as their fruit increases in weight. Our gourd frequently grows to the same height, and falls from it without being bruised. It is intended to ripen in the air, being the fruit of a creeping plant, which

has tendrils for the purpose of laying hold of trees. I have seen some of them of a considerable height suspended to cross poles like bells.

The fruits growing on the summit of high trees have either hard rinds, or soft and elastic coverings, the thickness of which is in proportion to their size. The nut is thus covered with its rind and its shell; the chesnut and the beech-mast with a kind of leather, as well as with a spongy and prickly capsule. The acorn is half incased in a collet, which preserves it from injury amid the branches of a tree exposed to the rage of tempests. All these fruits fall to the ground without breaking. The heavy cocoa-nuts are suspended to the palm-tree with still greater care. They grow in a cluster, all supported by the same stalk, which is stronger than a hempen rope of equal thickness. They proceed from the top of the palm-tree, and rest on its trunk, which affords them a protection in stormy weather; they have moreover very hard fibrous coverings, which are at once compact and elastic, so that they never burst in falling. Nature seems to me to have produced large fruits only on the margin of waters, into which they fall without breaking, and are easily floated. The creeping gourd appears to me of this description; for it is of greater size in cool situations and along the banks of

rivulets. The cocoa-tree is evidently intended to grow along the shores in the torrid zone; for it is not found to thrive in the interior. There exists a practice in some parts of India, of throwing salt into the holes or openings for planting cocoa-trees, in order to make them grow the faster; and they are observed to thrive in the sand along the sea shore, finding even there a solid hold, by means of the quantity of long filaments of which their roots consist. Their shape, resembling the keel of a ship makes them float at a great distance from the beach, and even in the open sea; where their size and dusky colour render it no easy matter to distinguish them amidst the azure waves. Again, in our country, the walnut thrives along the banks of rivers, and the humble filbert by the side of rivulets; its nut floats on the waters in the same manner as the cocoa-nut. Such is the correspondence between plants and their situations. To form an idea of the properties of a fruit, it is necessary to know its relations to the soil in which it grows to advantage, and to the plants that bear it, as well as to man and the animals who consume it.

While hard fruits intended for food apprize us of their ripened state by the noise they make in falling, others of a soft substance give similar indications to the sense of smell. The former

have, in general, very little smell, and can be left a long time on the ground without hazard of decay; while the latter give us notice, by means of the sense just mentioned, that no time is to be lost in gathering them. Smell may be considered as an anticipation of taste; and as a method of judging whether the food in question suits the stomach. Though we should have difficulty in explaining the process by which it leads our judgment, we may be satisfied that its instincts are more to be depended on than all the theories of physicians. The science of botany is not therefore to be accounted capable of defining, by its ordinary methods, the essential qualities of plants, I mean their relations with us as means of subsistence; since neither the smell, nor the taste, is referred to as a rule for the characteristics assigned to plants in the scientific nomenclature.

Botanical dictionaries are deficient even in the terms necessary to express the simplest smells; although there exists as great a variety in smell, as in colour, shape, motion, or sound. We are accustomed to define primitive colours by the epithets of white, yellow, red, blue, black; shape by the epithets linear, triangular, round, elliptic, parabolic; motion we characterize as perpendicular, horizontal, circular, elliptic, and parabolic; while sound, which arises merely from

the agitation of the air, is described as shrill, solemn, or hollow. We may find these distinctions of sound easily exemplified in the pronunciation of the vowel *e* in French, as well as of the other vowels of the alphabet; but we shall look in vain for proper terms to express the distinctions of smell. Such words as sweet, or fetid, are extreme terms, and not to be considered as characterizing specific degrees or shades in smelling; so that we find it necessary to describe them by a direct reference to the plants which are known to bear a particular smell. We consequently speak of the scent of a rose, a jessamine, an orange flower, &c.; and it generally happens that words formed of compounds of the names of such plants have been incorporated into language, for the purpose of defining the particular smell in question. The same is the case in regard to smells derived from the animal kingdom, such as musk and civet. It deserves to be noticed, that the strongest perfumes, like the brightest colours in plants, are found to arise from the flowers or sexual parts. The same holds in the case of animals, and particularly in those just mentioned; as well as in regard to the *castoreum*. We are unacquainted with the origin of amber; but it seems probable that it is engendered by the whale. In the same

way the colours of birds are brightest in the season of joy and love; a number of them being at that time decked out in fresh plumage, and ornamented with what may be termed purple epaulets and velvet trains, as if in full array for nuptial enjoyments. Although the perfumes of flowers are of almost infinite variety, our list of names for them is as yet extremely defective. The smell of the rose is not confined to that plant, but is common to it with several kinds of wood, as well as with the fruit of the flowering-rush, (*butomus umbellatus.*) And considering the number of different smells for which we have no adequate appellation, we are led to compare our notions on this head, with those of animals, who have an instinctive knowledge of things without comprehending their names. I am by no means certain that the knowledge of a list of names is particularly advantageous; for I remember Rousseau telling me one day, that it was possible to be a good botanist without being acquainted with the name of a single plant.

I may here take occasion to observe that I have often passed pleasant hours in a public walk, or in a private society, with persons whose names I never thought of inquiring, being contented with knowing them by their persons or countenance. Perhaps my backwardness in asking

questions about them proceeded partly from the apprehension that my ardour to esteem and love such persons might be checked by some of those unfavourable rumours which are so often current among us. I have long been of opinion that, to pass through life with comfort, it is necessary to conceal in some measure the origin of our gratification; and, for my part, I desire to know nothing more of an individual or of an object, than that a connexion with it is productive of pleasure. I consequently study man and nature as animals do, by mere instinct. A dog may be unacquainted with his master's name, and yet able to find him out in various situations that would be embarrassing to the personal friends of the individual. A dog will trace his master's footsteps through a numerous crowd, and will contrive to distinguish him with an exactness that has made certain philosophers go the length of exalting that animal at the expense of man. They ought however to consider that, although we should not be able to trace a dog in the midst of a number of others, merely by the sense of smell, that sense in us extends to a variety of odours of which the keenest scented dog is in a manner unsusceptible. It strikes me that each particular smell is connected with the scent of some animal or other whose instinct it awakens; but that man is capa-

ble of distinguishing all smells without being quite so much affected by any one as the individual animals to which I allude. Numerous as are the distinctions of smell, we might probably succeed in reducing them to five primitive ones; under which the others might be with propriety classed as mixtures and modifications. We are aware that colour, shape, motion, and sound, may each be comprised under five elementary heads; and why should we not succeed in establishing a relation between smell and the brain, the blood, the nerves, the gastric juice, and our humours at large? Anatomists have succeeded in analysing the organs of sight and hearing without having made any considerable progress in regard to those of smell, although that sense is so very frequently called into action.

These remarks in regard to smell are equally applicable to taste, the various distinctions of which are no less imperfectly defined in our nomenclature. Such expressions as sweet, harsh, acid, convey very imperfect ideas; while the words salt, bitter, saccharine, are derived, not from the taste in question, but from the objects which are known to produce it most decidedly. Here, as in the former case, we are obliged to make a reference to vegetables, and to trace discriminations of taste in fruits as we trace colours

and smell in flowers. It is thus that we talk of the taste of wine, pepper, or almonds, without being qualified to assign comprehensive names to the taste of any of those fruits, the colours of which, however, we find no difficulty in defining by such general epithets as white, red, grey, black, or brown. The varieties of taste are as numerous as those of smell, although the latter consist of two great classes, one of which, like the perfumes of flowers, affect the brain only, while the others are found to serve as a stimulant to the taste. At the same time all of them, even the rankest, are discoverable in the most favourite aliments. The aphrodisiac durion, which in India is accounted a great delicacy by both sexes, has the smell of a rotten onion. The Greenlander drinks stinking train oil with as much pleasure as a Chinese experiences from scented sherbet. Among ourselves how many persons past middle age give a preference to cheese of an unnatural taste, to that fresh milk diet which gratified them so much in their younger days. Wherever we go, we are led to the conclusion that each nation, each sex, has a taste of its own; but we are at the same time induced to draw the inference, that man combines in himself more or less the taste of all animals. He makes use of the food of all, and

mixes it in a variety of ways. I have already observed, and think it cannot be too often repeated, that the various classes of animals possess only rays or emanations of the different kinds of sensation, while man possesses the whole circle, and finds in this universality one of the grand distinctive features of his species.

Nature seems to have combined in our organs of taste, (which as yet are as imperfectly understood as our organs of smell,) all those means of ascertaining flavour, and accomplishing digestion, which she has given only in part to the different classes of animals. Some animals take in their nourishment by suction through a trunk, as is the case with flies, and several species of beetles, which derive their support from dissolving liquids; others, like the insect called caric, grind their food into a powder, or swallow it without chewing, and perform the digesting process by means of the gastric juice. This is the practice of most reptiles, while other animals reduce it by trituration, as is the case of birds with strong stomachs filled with small pebbles; or, like the ox, lay hold of it by a single row of teeth, and chew the cud afterwards; or cut it with two rows of what are called incisors, as in the case of horses; or tear it with canine teeth, like dogs and apes; or crush it by means of a mouth lined with rough

and convex bones, as in the case of certain large fish, who live on shell-fish. Now man combines in his frame a tongue, lips, gastric ju ces, cutting and canine teeth, as well as grinders, a stomach, intestines, and gullet, so that by thus uniting in himself what is possessed only separately by other animals, he has the power of making use of, and digesting, almost every kind of food.

We shall now proceed to take a view of the means provided for us in all situations by Nature, not merely to meet the call of hunger, but to meet it with gratification. Let us begin with the torrid zone, where the sun sends forth all his influence, and where man first knew existence. In that zone are to be found the most brilliant flowers, the most savoury fruits, the most delightful aromatics. I need not enlarge on its mines of gold, silver, rubies, emeralds, diamonds; treasures to which the other zones can oppose only mines of copper, iron, lead, and crystal; but confining ourselves to vegetable products, we find that we derive from the products of the torrid zone the names of those colours, tastes, and smells, with which we distinguish the colours, tastes, and smells to be found in our climate;—I mean that it is there we find primitive colours in all their simplicity, and that it is from the vegetables which bear them that we derive

our current names, such as the white of cotton, the yellow of saffron, the red of the rose, the blue of indigo, the black of ebony. The case is the same in regard to those smells which have properly no other name than that of the vegetables producing them; such as the smell of the rose, from which the Indians extract such precious essences; that of the jessamine and frankincense of Arabia; that of aloes and sandal wood, &c. It is in the torrid zone that the sun gives a savoury perfume, and an attractive taste, to pepper, cinnamon, nutmeg, cloves, vanilla; and it is there that he combines these attractions in a thousand fruits fit for nourishment, such as oranges, papaws, pine-apples, mangoes, dates, lee-chees, mangostans; all superior to our most delicate confectionary and preserves. Again, we find in this part of the world, in all their purity, the primitive tastes and smells for the purpose of food, of which man is enabled to make a variety of mixtures according to his inclination, such as the acid of lemon, the juice of the sugar-cane, the bitter of coffee. In the immediate vicinity of products like these, we find growing a number of farinaceous vegetables, some under-ground in roots of surprising thickness, as yams, manioc, and Spanish potatoes; others above ground, as rice, maize, corn, and leguminous grains of all

kinds. It is on trees, however, that Nature has exhibited most conspicuously, and in a situation the fittest for use, whatever can conduce to our pleasure and accommodation; such as bread on the bread-fruit-tree; milk and butter in the cocoa-nut; sugar, wine, and vinegar in the sap of various kinds of palm-trees; honey, sweeter than that of bees, in the date; fleeces, softer than those of lambs, in the pods of the cotton-tree; vases of every kind in the calabash; and, finally, a lodging inaccessible to the rage of the tempest in the arcades formed by the banyan fig-tree.

On examining the temperate zones, we find little more than the desert of this magnificent repast. We, who inhabit Europe, are obliged to come to the assistance of Nature by painful and continued exertion, while the native of the tropics needs do little else than afford free scope to the operation of the earth, water, and sun. I am even inclined to think that the vegetables in most common use among us derive their origin from a southern climate. The vine, the peach, the apricot, and the fig-tree, are found in the mountains of India, and form the ornament of the lofty region of Cachemire. It was from a southern climate that our arts, our sciences, our laws, our religion, and even our amusements, originally sprung. Pythagoras, the father of

philosophy, is said to have sought in Asia the elements of moral and natural philosophy, and to have imported from thence into Europe that course of vegetable diet which bears his name, and is found so favourable to our health and tranquillity. Some persons imagine that this diet has a tendency to weaken our bodies, and enervate our courage; but they do not consider that in the animal creation there is no necessary connexion between the possession of courage, and the habit of living on flesh. Are the cock, the bull, the horse, less strong or less intrepid than the fox, the wolf, or the tiger, who belong to the carnivorous tribe? The latter, though armed with claws or sharp teeth, fight only in concealment and by surprise, in the shade of forests, or the darkness of night; while the former, though less formidably prepared for combat, are seen to contend gallantly in open day. The Japanese are said by Kempfer to abstain religiously from animal food, and are still not less vigorous or more apprehensive of death than other nations. Their customary food consists of vegetables and shell-fish, yet no persons are found to meet death with greater calmness when their situation calls for it. It is worth observing that they have found the means of employing, for the purpose of food, a number of sea-plants,

which in Europe are so little attended to as to be unknown even to botanists. The only use we make of such plants is to fatten our land with them when the tempest throws them on our shores. Yet a number of the plants and fruits which we account luxuries, such as tea, coffee, cocoa, olives, are naturally of a bitter and disagreeable taste; nor could we make use of our corn or our vegetables, without converting them into food by the processes of grinding, baking, boiling, &c. After having thus learned the importance of preparation in regard to the vegetable products of the ground, why should we not, like the Japanese, follow a different course with the vegetable products of the sea?

A vegetable diet may however be rendered perfectly agreeable without waiting for the attraction of additional plants. It was adopted in preference by many distinguished characters in Greece, at a time when the extent of vegetable supplies was much more limited than at present. Among those we may reckon Ocetes, who first discovered the motion of the earth around the sun; Archytas of Tarentum, who invented the sphere, and obtained so much reputation in Sicily by the mildness of his government; Lysis, the friend and instructor of Epaminondas; and finally Epaminondas himself, the greatest

captain, and the most virtuous of the Greeks. How can we complain of Nature now that all parts of the world have contributed to enrich our fields, our gardens, and our orchards, not only with leguminous plants, but with exquisite fruits. We have within our reach the strawberries of the Alps, the cherries of the kingdom of Pontus, the apricots of Armenia, the peaches of Media, the figs of Hyrcania, the melons of Lacedæmon, the grapes of the Archipelago, the pears and walnuts of Crete, the apples of Normandy, and the chesnuts of Sicily. Flora and Pomona reign in our climates throughout the whole year, and furnish in every month something new to our table.

But were we even exiled to the extremities of the North, to those countries where there is neither spring nor autumn, the gifts of Ceres and Palès would still be found sufficient to render our life not only innocent but pleasant. I remember that, when serving in Russia in an engineer corps, on surveying the forests of Russian Finland with General Du Bosquet, who was at the head of the engineer department, that we perceived the ruins of a cottage, and the furrows of a small field in the midst of rocks and firs. This was about a league's distance from Wilmanstrand, a small town situated near the sixty-first degree of North latitude. The General was well acquainted with Finland, having married in that

country, and told me that the field in question had been cultivated by a French officer, who had been in the service of Charles XII. and had been made prisoner by the Russians at the battle of Pultawa. That officer fixed his abode in this desert, where the ground, covered with snow during six months, and encumbered all the year through with stones, repaid his labour only by a scanty crop of barley, cabbage, and indifferent tobacco. He kept a cow, and was in the habit of going every winter to Petersburg to sell his small stock of butter. The French ambassador at that court, M. de la Chetardie, invited him repeatedly to come to see him, and held out the promise of an employment in his native country, but he refused both the invitations and the accompanying offer of pecuniary assistance to facilitate his return home. He had entirely forgot his mother tongue, and understood only that of nature; he had married the daughter of a Finland peasant, and seemed to feel no blank in his comfort, except from the want of children. I had heard before this of several Europeans embracing a kind of savage life in America, and I was well aware that no savage had ever renounced his original habits to adopt those of civilized society. But of all these examples I have found none so remarkable as that of a Frenchman pre-

ferring the toilsome and laborious life of a peasant, in the barren and forbidding Finland, to the ease and pleasure of a military career in the mild climate of his native country. Poverty and obscurity may thus be said to have their advantages, since by submitting to them we may make sure of the enjoyment of personal liberty under a despotic government; while fortune and reputation often load us with fetters in the midst of a republic. I confess that the ruins of this little cottage, surrounded by mossy furrows, left on my mind a more profound impression, and a more affecting recollection, than the imperial palace of St. Petersburg, with its extensive gardens, and its 800 pillars; a palace replete, like every other palace in the world, with vain pleasures and bitter solicitudes. I still recall with delight the idea of this lowly dwelling in Finland, situated in the middle of rocks, on the border of a forest of pines, near the lake of Wilmanstrand; affording indeed, in the short summer of that region, but a few sheaves of barley to the cultivator, but conferring on him permanent liberty, security, innocence, and a safe retreat to conjugal fidelity.

I have seen a display of cherries and gooseberries with ruddy tints in barren districts of Finland, and on soils where, as on the tops of

Alpine mountains, rocks appeared to form the only surface. I have seen the borders of a forest studded with strawberries, mushrooms, and bilberries. How many fruit-trees of our own, and even of warmer climates, must be capable of withstanding the severity of winter, when the paper mulberry of the southern ocean, the tree affording the varnish for japanning, and others equally appropriate to a warm climate, are found when planted in our gardens to resist those intense frosts which are experienced in the rude winters of 1794 and 1799. It is not unworthy of remark that Nature gave birth to her most successful disciple Linnæus, in one of her most forbidding climates. How many ingredients in diet and in drink are extracted from corn, of which every climate produces one species or other! Barley is raised in Finland in the course of a summer which lasts only three months, but which approaches in heat to that of the equinoctial. What a number of exotic plants might be successfully cultivated there during that season short as it is.

Not only has Nature given us vegetables in harmony with all our physical wants; she has afforded them to supply those enjoyments which may be called of a moral kind, such as the laurel of the conqueror, and the olive of the pacificator.

She has produced plants of a suitable character in those situations which seem by their religious and melancholy appearance to be destined for our obsequies. I speak not merely of those which served for funeral piles among the nations who, like the Romans, were in the habit of burning the dead, for trees of any description are fit for that purpose; I allude to those which are calculated to diffuse an aromatic odour, or to afford by their appearance a suitable decoration to the tomb. For the former, the Egyptians made use of resinous matter extracted from myrrh, spikenard, cinnamon, and balm, from which is consequently derived the expression to "embalm." They were thus enabled to preserve from putrefaction the bodies of their ancestors, and to make them into mummies of the greatest solidity and durability. The Turks are in the habit of putting merely olive branches in the coffins of their dead, as some nations in the North of Europe put juniper leaves, leaving them to decay and to sink into our common mother the earth. The country people in my quarter are in the habit of using water-mint for the same purpose, and of sometimes fastening, on the door of the house where a young woman has died, a white cloth covered in different places with the gloomy leaves of ivy. I observed one day, in a poor village in Lower

Normandy, a dark circular spot in the green before a cottage, and was told by a neighbour, with tears in his eyes, that the inhabitant of the humble mansion had been dead for some days, and that the straw of his bed had been burnt before his door agreeably to the custom of the country. On this occasion the grass was consumed to the roots, and the dark colour of the spot would continue to form a contrast for a considerable time with the surrounding verdure. I could not help remarking the analogy between the consumption of the straw, and the transitory nature of our life; and I left the spot with the impression that this epitaph, impressed upon the ground by poverty and friendship, was more justly expressive than those which make a pompous figure in bronze and marble.

In Paris, that abode of wealth and ostentation, we are in the habit of employing for funerals only a few boards of fir, of which we construct a coffin, and deposit in it the remains of the deceased covered with a homely winding sheet. Our next step is to convey the coffin and its contents to an immense receptacle which has been prepared in subterraneous quarries under the southern part of the city. In this abyss it is thrown for ever amongst a multitude of dead of both sexes and all ages. Often, it must be confessed, does it

happen that the grave-diggers or other persons come during the night, and strip the corpse of its coffin and its covering; nay, it is well known that they not unfrequently dispose of the body itself for the purpose of surgical dissection. Can there be a more revolting idea than that of the exposure of the body of a young person, whose parents are at the time immersed in grief, and employed perhaps in vain orisons to heaven for the recovery of their child? Why do not the teachers in our surgical schools bear in mind that the knowledge which they thus communicate is materially depreciated, when accompanied by an infringement of delicacy in the minds of their pupils?

But supposing the dead bodies to remain undisturbed in the vast receptacle I have mentioned, the vapour arising from the mass of bodies is such as to threaten destruction to those who might venture to re-visit the relics of their relations. A son might here incur the danger of catching a mortal disease at the side of him to whom he had been indebted for existence! Such indeed is the confused heap of dead bodies covered with a slight surface of earth, that it is a matter of difficulty to recognize a relation. Nor is there time allowed for the body to waste into its kindred element on the spot, the frequent occurrence of

deaths in so populous a city as Paris leading frequently to the occupancy of lately formed graves by new tenants. It would be disgusting to recapitulate the members which are thus mutilated and exposed to view. Suffice it to say, that a burying-ground in a populous city is generally a revolting object; and that when the pale light of the moon exhibits to view a church-yard and its gloomy environs covered with thistles, you are induced to believe yourself on that magic ground where poets have represented assemblages of sorcerers.

Yet this globe, ample as is its space for the living part of mankind, ought not to be deficient in room for the deceased. In every situation Nature has planted vegetables calculated to correct a mephitic tendency in the air, and to serve for decoration to our tomb-stones by their melancholy and religious appearance. Among plants, the creeping-mallow with its flowers streaked with purple, and the asphodel with its long stalk adorned with white or yellow flowers, are observed to thrive on the funereal clod. The white species of the latter is found chiefly in the southern parts of France and of Europe, where, like the yellow species, it has been found to grow along with the mallow. This appears to receive confirmation from the ancient inscription, "With-

out I am surrounded with mallows and asphodel, while within I am but a corpse." The asphodel is of the lily genus, and rises to the height of two or three feet. Its beautiful flowers deserve to be made an object of cultivation, and produce seeds from which the superstitious persons of antiquity thought the dead extracted a kind of nourishment. Homer tells us that, after crossing the Styx, the shades of the dead passed along an extensive plain of asphodel.

In regard to funereal trees, I find two kinds of them scattered in different climates, and marked by very opposite characteristics. One kind lets its long and thin branches hang to the ground, and receive an impulse from the wind. Trees of this description appear dishevelled, and suggest the idea of a lamentation in misfortune. Such is the *casuarina* in the isles of the South Sea, planted assiduously by the natives near the tombs of their ancestors. We have in our own country the weeping-willow; the same on which the captive Jews hung their harps at Babylon. Our common willow, when the head is not cut off, lets the ends of its branches hang down and assume an aspect of melancholy; an aspect which Shakspeare perfectly felt and expressed in the song of "The Willow," which he puts in the mouth of Desdemona, when on the point of end-

ing her melancholy career. Various other kinds of trees have their branches suspended in the same solemn manner. I have had an opportunity of seeing several of this description, such as certain kinds of the ash, the birch of the North, and the fig-tree of the Isle of France, whose fruits hang down to the ground.

The second kind of funereal trees are those which rise in the form of an obelisk or pyramid. If the former class seem to point our melancholy towards the earth, the latter appear by their branches to direct our hopes to heaven; such are among others the mountain-cypress, the Italian poplar, and the firs of the North. The cypress, with its floating and spiral foliage, bears a considerable resemblance to a long distaff covered with wool, such as the imaginations of the poets placed in the hands of the Fates who spun the thread of human destiny. The Italian poplars are said by Ovid to be the sisters of Phaëton deploring the loss of their brother, and raising their arms to heaven. The pine appears a very proper tree for the decoration of a tomb-stone, and it is frequently applied to that use by the Chinese and Japanese, who consider it a symbol of immortality. In truth, its aromatic odour, its solemn and perpetual verdure, its pyramidal shape pointing to the clouds, and the hollow moan of its

branches when shaken by the wind, seem to adapt it admirably for a mausoleum, and for impressing our minds with a sentiment of immortality. Let us accordingly plant around the graves of our friends, trees replete with this expression of melancholy. Vegetables are the letters of the book of Nature, and a church-yard ought to be a school of morality. It is on such a spot that the contemplation of the mighty, the rich, and the wicked, humbled into dust, makes human passions disappear, and suspends, for a time at least, the influence of pride, avarice, and envy. It is on such a spot that the dearest affections of our nature revive at the remembrance of children, parents, friends, and conjugal partners. It is on tomb-stones that the nations of the East distribute provisions and afford relief to the indigent. Let us at least surround them with plants calculated to keep our friends in our recollection. We sometimes erect urns and statues to their memory; but time soon injures the monuments of art, while it gives every year additional strength to those of nature. The old yews of our church-yards have been known to outlast churches built after they were planted. Let us shadow in future our cemeteries with plants characteristic of the different classes of citizens who lie there in peace; let there be planted on the graves of particular

individuals, trees or shrubs appropriate to their respective professions; such as the osier on the tomb of the basket-maker; the oak on that of the carpenter; the vine-stock on that of the vintager. It should be a rule to place there in preference those evergreens which are adapted to recall those never-fading virtues which constitute the essence of patriotism. Let the pale violet and the gentle primrose extend their flowers every spring on the graves of dutiful children; and let the pervenche (*vinca*) of Rousseau, dearer to lovers than the myrtle, display its azure flowers on the tomb of faithful beauty. Let the ivy embrace the cypress on the tomb of the married pair who have remained faithful until death; let the laurel characterize the warrior; the olive the pacificator; and finally, let the stones bearing inscriptions in praise of those who have deserved well of mankind be shaded by privet, box, juniper, holly, honeysuckle, and by the majestic pine. May it be my lot to walk one day through this Elysium, enlightened by the rays of the morning, the blaze of the setting sun, or the pale face of the moon, and rendered sacred for ever by the ashes of virtuous men! May I be thought worthy to have my grave surrounded by those of my children, and surmounted with moss-covered stones! By thus decking the abode of their an-

cestors, nations have rendered the tombs of the esteemed portion of their citizens respectable in the eyes of posterity. In this garden of life and death, of time and eternity, there will one day be formed minds sublime and intelligent like those of Confucius, Fenelon, Addison, and Young. On such a spot the vain illusions of worldly objects will disappear before the view of so many men mowed down by death; on such a spot the hopes of a better life will be animated by the recollection of their virtues.

VEGETABLE HARMONIES,

OR

A BOTANICAL LESSON TO PAUL AND VIRGINIA;

FOLLOWED BY AN ECLOGUE OF VIRGIL.

PRESIDE over the games of our children, Flora, charming daughter of Aurora: it is thou who coverest with roses the fields of heaven traversed by thy parent, as well in her daily progress over our horizon, as when she advances in spring towards the summit of our hemisphere, and casts rays of gold and purple on snow-covered regions. Thou, suspended over our green fields, and carried by the rainbow into the bosom of the clouds, scatterest flowers with a liberal hand over our vallies and forests. The playful zephyrs pursue thy steps, and urge thee on with their warm and humid breath. Already do we perceive on earth, the marks of thy course through the sky; the heaths fertilized by rain are yellow with broom in flower; the fog-covered meadows display the gilded crowfoot; and the cornices of the antique castle are covered with saffron wall-flowers. In the midst of a cloudy day, we imagine that the rays of the sun shine at a distance on the tops of eminences, on the bottom of vallies, and the summits of ancient monuments; while rows of

violets and primroses perfume the hedges, and the lilac covers with its purple the walls of the distant castle. Innocent children, come forth into the fields; Flora calls you to sport in the meadows; every thing invites you thither, the woods, the waters, and even the bare rock; every spot offers you plants, and every plant offers you flowers! Hasten to enjoy the month which affords you this gratification! April is in the dawn of the year, as you are in the dawn of life; learn to understand her smiling gifts. Let the meadows be your school, the flowers your alphabet, and Flora your teacher.

We call in no formal master to instruct children about plants: let females teach them whatever is most interesting in the vegetable world, for there is a connexion and a sympathy between it and the tender sex. The trees appear intended to afford a shade to females; the grassy turf is for their repose, the flowers for their ornament. Who more skilful than they in assorting flowers, and weaving them into crowns and garlands? It was under the tuition of the female florist of Athens, the object of his love, that Pausias became so dexterous in painting flowers. Women themselves are called the flowers of life, and children its fruits. It is they who form the charm of our societies, whether they mingle in the dance, or recreate themselves in our public walks,

surrounded by their numerous progeny. All that is most agreeable to the imagination is represented under the figure and name of females. The ancients gave a female form and name to the morning; to the winged Hours harnessing the horses to the chariot of the Sun; to the rainbow, known by the appellation of Iris; to the Naiads, Nereids, Oreads, the most lovely divinities of the air, water, earth, or forests; to the Muses, the Virtues, Graces, and to Venus herself, who was figured as uniting every charm in her person. It is true that feminine names have likewise been given to unpleasant and destructive objects, such as diseases of the body, of the mind, and of political societies; I mean hunger, thirst, fevers, contagion, jealousy, envy, calumny, hatred, and to war, which, under the name of Bellona, may be considered an assemblage of evils of every description. Not that females are more subject to those cruel passions than the other sex: on the contrary, their mild and compassionate disposition renders them less susceptible of them; but these passions are additionally dangerous when they happen to centre in a female form. While virtue is doubly attractive in a beauteous person, vice is doubly hideous. Women are said to go to extremes in evil as in good, and to inspire similar sensations into men; exquisite en-

joyments and acute griefs may be said to belong to the delicate part of the creation. It is then the province of those who have such a refined sense of pleasure, to undertake the task of teaching it to others; and be assured that no pleasure is of a more attractive or innocent cast, than that which arises from botanical studies. Poison may sometimes be extracted from that source; but that evil is trifling in comparison with the long list of blessings derived from it in the shape of nourishment, medicaments, perfumes, and ornaments. If the cup of Medea cost some unfortunate beings their lives, that of Erygone is the daily support and delight of mankind at large. The moly of Minerva affords the means of preserving us from the enchantments of Circe. If females among us do not, as among the ancients, give their attention to the attractive study of botany, the reason, I imagine, is to be sought in its being beset by so many phrases borrowed from the Greek, and unintelligible to them; while, in the analytical shape exhibited by our systems, the science offers a mere succession of skeleton forms. I am not without hopes that, by pursuing the course pointed out in these pages, females will find flowers accompanied in the fields by the same attractions as they possess when displayed on their own heads or bosoms.

A mother is, in my opinion, capable of teaching children all that it is useful or agreeable for them to know in regard to botanical studies. The observations in the preceding pages on vegetable harmony are principally calculated for matured minds; but to children a different language should be held. Serious inconveniences are found to result from the books, however ingenious, which have been contrived to aid the expansion of the youthful mind. The narratives contained in such books, whether imaginary or extracted from antiquity, are seldom similar to the existing state of society; and children can hardly ever be brought to apply in practice the principles and examples given to them in theory. Like the older part of our species, their behaviour is generally determined by what they see passing under their eyes. When, as is often the case, books of this description are wearisome to them, they either do not read them, or, what is worse, if they are made to read them, they contract an aversion from books, which lasts during the remainder of life. On the other hand, if children find a great amusement in books, they are apt to think that reason and pleasure are, in a manner, confined to the impressions thus conveyed. The personages described in their dialogues take too strong possession of their minds, and the go-

verness, who is there represented as maintaining perfect equanimity, and holding forth a succession of agreeable tales, may engage their affections more warmly than their own mother. In stating these objections, my wish is that, instead of books, we should exhibit things themselves to children; and that a mother should hold a conversation with them on whatever might present itself, exactly in the way that Socrates did with his disciples. The impressions arising from the personal occurrences of our childhood, accompanied by maternal lessons, take the deepest root in our memory, because they penetrate into our heart: it is the lessons of a mother which gives so much permanency to our religious sentiments through the whole course of life. These sentiments acquire strength and maturity with the progress of our reason; and after having played around our cradles in our days of innocence, they come forward to our support in the age of passions. I am anxious therefore that the sentiment of a superintending Providence should be impressed on the minds of children, not by a formal teacher, but by a mother. The former merely inculcates, the latter inspires affection: the Deity described to us by a mother is always the kind and indulgent Deity of nature. Such lessons should be taught, not in town, but in country; not in a

church, but under the canopy of heaven; not from books, but from flowers and fruits.

There is an easy method of conveying instruction to the least informed persons, I mean that of going from the simple to the compound by a synthetic process. This method is not adopted by our professed instructors, who prefer the analytic or decomposing method, I mean that which proceeds from the compound to the simple. The reason of this preference proceeds, in my opinion, from the analytic method supposing a mind of a great extent capable of embracing an object in all its compass, and of subsequently reducing it to its first elements. This method, however, as Montaigne observed, is subservient to the perversion of knowledge; for it is by means of it that some late philosophers have undertaken to prove that air is not an element; that there are about forty primitive and unchangeable descriptions of matter in fossils; that all the laws of motion, and even of life, proceed from attraction; and lastly, that there is neither a soul in animals, nor a God in the universe. The analytic method makes a strong impression on the multitude, who reverence always what they do not understand; but I cannot help thinking its adoption a proof of our weak and imperfect manner of reasoning, which, from an

incapacity to embrace different considerations at a time, makes an effort to reduce them into a single object, and loses sight even of that in the progress of the intricate investigation.

Synthesis, on the other hand, teaches us to generalize our thoughts, and the properties of every department of nature. Let us, by way of forming an idea of the two methods, apply them respectively to observations on the sun, the great agent in our system. Supposing one of our doctors to undertake to ascertain the properties of the sun, he will begin by getting out of the mist that covers our plains, and will choose the summit of a lofty mountain for the scene of his observations. In proportion as he rises above the horizon, he finds the meadows, the orchards, the forests, successively disappear; and he arrives at last at rocks devoid of verdure, where water, reduced by its want of heat to its natural state of freezing, becomes changed into enormous masses of ice; while the surrounding atmosphere is so thin as hardly to be adapted to respiration. In such a situation the sun, deprived of his vivifying rays and brilliant refractions, appears to him, even at noon, in no other light than as a small globe not many inches in extent, in the midst of a dark blue sky. Such is the result of the analyzing process. But suppose an illiterate man,

like myself, accustomed to proceed from the simple to the complex, to come down from this lofty summit, every step I make will discover to me some new quality of the soil. On entering an atmosphere of vapour, we see the sun's rays, tinged with purple, expand the air, and melt the ice into streams and torrents. The conclusion is, that the solar rays are decomposed into colours; that they possess heat; and that they, to a certain degree, kindle our atmosphere from the moment they appear above our horizon. In considering subsequently their operation on the solid mass, we find that the sun exercises an attractive power over it, inasmuch as the earth turns incessantly around him; we are led to infer that so powerful an influence may be productive of effects even on the interior of the globe, and may be a primary cause of the existence of gold and precious stones, which, be it observed, are chiefly found in the bosom of the torrid zone.— On reaching the sides of the mountain where vegetable power appears once more, we are led to contemplate new properties of the sun, and to observe his rays penetrating forests, opening their leaves, giving a colour to their flowers, impregnating their seeds, and adding every year a ring to their majestic trunks. Lower down, we perceive the rays of the sun extending into orchards,

and conferring colour, scent, and taste on fruits; while the mind is induced to entertain a doubt whether they are not instrumental in the formation of amber and sugar. Finally, on descending at night-fall to the bottom of vallies, we hear birds sing and cattle low, at the time when the last rays of the sun gild the summits of the mountains. On his finally disappearing, the animal creation seem to suspend their motion, their sensation, and, for an interval, their life; for they sink into profound sleep. One might almost imagine that their life is a portion of that heavenly flame which enlightens and animates the air, the water, the earth, and the forests. The course of their daily proceedings is regulated by the different hours of the sun's course, in the same way that the seasons of their love and their epochs of birth are regulated by specific periods in his annual course.

Man alone is able to kindle fire in the midst of darkness, and to make it subservient to a variety of uses. He makes it proceed from the trunks of trees, and sparkle on his hearth. Even in the darkness of night, it is ordered by Providence that an indirect advantage should result to man from the light of the sun, for it is reflected in the firmament by planets accompanied by their numerous satellites. We see them alternately as-

cending and descending in the east, in the west, on horizontal, oblique, or perpendicular lines, and forming squares, triangles, or parallelograms, by their various combinations. This celestial telegraph speaks to us incessantly in a mysterious language, which announces all the harmonies of time, whether in minutes, in hours, in days, in months, in seasons, in years, or in ages. It expresses likewise all the æras of existence, of birth, of age, decrepitude, and death. Sometimes a fiery comet traverses the firmament, and strikes the superstitious beholder as a signal of the destruction or creation of a part of the universe. Perhaps every fixed star has, like the sun, signals of this description for the particular universe which it may illumine.—Our sun may justly be said to be for mankind the book of immortality, since it is under his influence that we cherish those sentiments which, in this transitory existence, afford the best foundation to our hopes.

We become acquainted then with the qualities of the sun only by combining them in a sympathetic manner with the other powers of Nature, and we lose sight of these qualities so soon as we proceed to separate them by the process of analysis. The same holds in regard to the other departments of Nature. The faculties of man are known to us only by being put in connexion

with the elements, vegetables, animals, and particularly with beings of our own species. It is by approximations such as these, that we arrive at a demonstration of the existence of a rational soul. Even in regard to the Divinity, our course of reasoning must be similar, for we can form an idea of his power, his intelligence, his eternity, his goodness, only by tracing these attributes in his various works. Nothing is more calculated to weaken the impression of them than the meditations of the solitary thinker, who may be said in a manner to decompose them in his brain. No man is in greater danger of becoming a materialist than the metaphysician, because the spirit of analysis which leads him astray is the offspring of the pride and weakness of the human mind.

Botany, like other sciences, has been treated by an analyzing process; men have taken the leaves out of plants to ascertain their nature, in the way that children do, and we might almost say, with little better success. But if we alter our method, and connect vegetables with the other powers of Nature, their flowers with the sun, their stalks with the wind, their leaves with rain, their roots with the ground, their fruits with men and animals, we shall find a thousand useful and agreeable articles of information sug-

gested by this new direction of our studies. A meadow suffices to give children some idea of the power of the sun; and the flowers point out, with considerable accuracy, the different periods of the day or of the season. If the stars, by their magnitude and the extent of their course, give birth to sentiments of admiration and religious respect, flowers, on the other hand, are productive of gaiety, innocence, and pleasure. Let us even leave children to imagine for themselves a system of botany. If they suppose that the petals of roses are concave for the purpose of being flapped against their foreheads; that the marks on the stalks of certain gramina supply them with the means of expressing the extent of their mutual friendship; and that the down on the seeds of the dandelion is constructed so as to be blown away in a single breath, who will maintain that their system is not as good as that of Linnæus? The flowers of a meadow may be said to be formed as well for the purpose of serving for nosegays and chaplets, as for being swallowed by animals or dissected by naturalists. Most of them may be even said to have a connexion with children by their size and colour; a connexion which may extend, by the aid of a little fancy, to the strawberry, the peach, the apple, and other fruits.

Without indulging these speculations farther, I return to my former idea, that it is to females, and particularly to a mother, that it belongs to give children the first notions of botany. The true method is to proceed from simple to compound; advancing step by step from a humble plant to a comprehensive view of the order of the universe. I shall now proceed to give a sketch to the female teacher, who should be considered in the light of the mother of the children, as the preceptor is considered their father. Let us suppose a mother engaged in giving some ideas of Nature, and of the Author of Nature, to two children, a boy and a girl, whom we shall name Paul and Virginia. To these names I have, I hope, been instrumental in attaching some interest. When I was unmarried, and when I published the first volume of my "Studies of Nature," I said in that work, without suspecting that there would be any truth in my prophecy, that "the next generation would in some respect belong to me." This was meant to apply only to those improvements in education with which I was then occupied; but I have had my wishes fulfilled in other respects, for I can hardly go into a public walk without hearing mothers or nurses, brothers or sisters, call children by the name of Paul and Virginia. I often turn uncon-

sciously around, and imagine for the moment that these are my children, for I also have a Virginia and a Paul, who form a crown of roses for my grey hairs. I embrace accordingly the opportunity of using their names with the greater pleasure, as it will enable me to exhibit a sketch of their opening dispositions. My Virginia is now five years old, and will soon become capable of understanding such lessons; my Paul is an infant scarcely twelve months old, but he discovers the mildest disposition, and the warmest affection for his little sister. Amiable minds alone are fittest to enter into the studies of nature.

THE MOTHER, VIRGINIA, AND PAUL.

THE MOTHER.

How pleasant the month of April appears after so severe a winter! Let us rest ourselves at the bottom of this oak, which displays its earliest leaves. Let us sit down on the grass, and do you, my little girl, amuse yourself in gathering flowers, while I hold your brother on my knee.

VIRGINIA.

I am going to make a great nosegay both for you and for myself.

THE MOTHER.

Here, look at these violets at the foot of the eglantines.

VIRGINIA.

How sweet they smell! I thought they grew only in gardens: mamma, how do they call these white flowers which grow among the violets, and smell so sweet likewise?

THE MOTHER.

These are primroses.

VIRGINIA.

And those in the middle of the wood?

THE MOTHER.

These are hyacinths and lilies of the valley.

VIRGINIA.

Ah! here are daisies in the grass; how pretty they are; some of them are half open. What is the reason they have a small green covering which wraps them half round?

THE MOTHER.

That is to protect the flower, and it is called a calyx, or cup. Many flowers have a protection of this kind, which answers the same purpose as the wadded roller fastened round the head of your little brother to prevent him from hurting himself by falling.

VIRGINIA.

But flowers are not apt to fall.

THE MOTHER.

No; but they strike against each other when the wind is high.

VIRGINIA.

And these white leaves of the daisy, red at the point, what purpose do they serve?

THE MOTHER.

To transmit the sun's rays to the middle of the flower; they are called petals.

VIRGINIA.

What are these small yellow buttons, like pin heads, in the middle of the daisy.

THE MOTHER.

These are florets, and stand in need of heat before they come into flower; this is the reason that most flowers have their aspect towards the sun. But this is taking me beyond my depth; your father will explain this to you when you grow older.

VIRGINIA.

Why did he not come along with us? he would have found it very pleasant.

THE MOTHER.

He would, for he is fond of the *bois de Bou-*

logne; he used to walk there frequently with Jean Jacques.

VIRGINIA.

Who was Jean Jacques? I never saw him along with my father.

THE MOTHER.

Because he has been dead a long time; he was a man much persecuted, because he took the part of the unfortunate: he was very fond of children.

VIRGINIA.

Why did not my father accompany us as usual?

THE MOTHER.

He remained at Paris on business; on account of a process at law.

VIRGINIA.

What is a process?

THE MOTHER.

A kind of war carried on to exact what we do not owe, and to withhold payment of what is due to us.

VIRGINIA.

But in war, people destroy each other.

THE MOTHER.

And in law, people destroy property, and sometimes reputations.

VIRGINIA.

We are then much to be pitied, and men must be very wicked, who act so harshly towards my father. (*She begins crying.*)

THE MOTHER.

You are too easily hurt, my poor Virginia; do not cry; if men are unkind to us, Providence will protect us! Let us return to Nature; she is the work of Providence.

VIRGINIA, *laughing and running.*

Oh! how many flowers are in the grass; here are white, yellow, blue, red, violet, and of all sizes. I wish to know the names of them all.

THE MOTHER.

That I cannot tell you; but you will show them all to your father, who will tell you the names, and I shall learn them along with you; for at present I know no more of them than you do.

VIRGINIA.

I believe I know several of them already; here are roses, pinks, jessamines, violets, daisies, and a name that I have forgotten, but which I should recollect on seeing the flower.

THE MOTHER.

You will have no more trouble in remembering

their names than the names of the letters of the alphabet.

VIRGINIA.

True, mamma, if you teach me them; flowers are prettier than letters. I should like to be able to read that meadow as I read a book.

THE MOTHER.

We do not as yet know how to spell the alphabet of Nature, and how should we then be able to collect her thoughts on the subject?

VIRGINIA.

Here are a number of white flowers along the wood; they are like daisies, but larger.

THE MOTHER.

Do not pluck them; these are strawberry flowers, and in the course of summer will be changed into strawberries.

VIRGINIA.

How! are strawberries flowers in the outset?

THE MOTHER.

Yes, child, just as much as women are, in the first place, little girls.

VIRGINIA.

And the other flowers of the meadow, do they become fit for eating?

THE MOTHER.

No.

VIRGINIA.

Then they are of no use?

THE MOTHER.

Ah! none of them, be assured, are devoid of use; the bees come to suck them for honey.

VIRGINIA.

What is a bee?

THE MOTHER.

See, there is one on the flower of a lily of the valley—take care not to touch it, or it will sting you; but you may look at it, as it will not hurt you unless provoked.

VIRGINIA.

I see it put its head in the cup of the lily flower, exactly as I put my finger into my thimble. It gathers with its sharp point a kind of yellow dust, which it places on its little thighs by means of its fore feet. Look at this, mamma, for it is very curious. See likewise a number of others on other flowers; but I see none on the leaves; are not the leaves then good for any thing?

THE MOTHER.

Yes, they are; the cows in that meadow will very soon eat them and transform them into milk.

VIRGINIA.

I did not know before that milk proceeded from plants, and honey from their flowers.

THE MOTHER.

The bees extract wax likewise from flowers; while sheep are the medium of producing wool out of grass; and hens give us eggs from the grains of corn which they eat.

VIRGINIA.

But what power has given existence to these plants?

THE MOTHER.

It is God, my dear.

VIRGINIA.

But how do they come to shoot forth, for I see no gardener here?

THE MOTHER.

It is the sun that warms them, the rain that bedews them, and the wind which deposits their seeds on the ground.

VIRGINIA.

Oh! how great is the knowledge of God!

THE MOTHER.

Yes, my dear, it was he who made the sun, the winds, the rain, the plants, the bee who extracts honey from flowers, the cow that changes grass into milk, and man, who enjoys all these blessings, often without proper gratitude.

VIRGINIA.

Oh! how great is the goodness of God, and

how thankful we ought to be! He has made nothing but what is useful; but these vile caterpillars which destroy the leaves of the trees are certainly not the work of his hands. One of them has just fallen on my face, and a very ugly insect it is.

THE MOTHER.

It is from these caterpillars that the beautiful butterflies proceed, which you are so fond of running after.

VIRGINIA.

How can that be? Is it possible that there can be a butterfly in a caterpillar?

THE MOTHER.

Yes, child; it is enclosed there as your scissars in their sheath. I cannot explain it to you, but one day I shall show it you.

VIRGINIA.

Oh! pray let me see it immediately.

THE MOTHER.

My dear, I can no more show you at present a butterfly in a caterpillar, than a strawberry in its flower; we must wait till the sun has given ripeness to both.

VIRGINIA.

Ah! I see a bird carrying off one of them.

THE MOTHER.

It is for the purpose of giving it to its young

brood to eat; without insects the birds would not have sufficient nourishment in a season when there are neither grains nor ripe fruits.

VIRGINIA.

But of what use are birds? They seem to me to be of very little, since we cannot catch them.

THE MOTHER.

They serve to spread gladness among mankind by their songs. The one you have just seen is a nightingale; he is dark-coloured like a sparrow, and has a long beak. He is gone into that eglantine bush covered with little roses; his nest must be there.

VIRGINIA *runs to the bush.*

Oh! let me go and take the young. (*She returns crying.*) Oh Mamma! I have hurt my hands; the blood is running from them; I am going to die.

THE MOTHER.

Do not be afraid, you will not die; and if you did, death is a return to God who is good.

VIRGINIA.

Mamma, how can I reconcile it to the goodness of God that he should have put thorns among roses?

THE MOTHER.

These thorns are sometimes put there for the

purpose of protecting the young of birds in their nests.

VIRGINIA.

Why should not I be allowed to take the young? I would not have injured them; I would have put them in a pretty cage along with my goldfinch.

THE MOTHER.

And what would you say were any one to carry you away from your mother, and to place you in a pretty house? Why should you cause to the mother of the bird that pain which you would be sorry to see another inflict on me?

VIRGINIA.

Oh! I now see the goodness of God in watching over the young of birds; but what if there were no God?

THE MOTHER.

In that case there would be neither plants, caterpillars, birds, little girls, fathers, nor mothers; all would be in confusion; it is God who creates all.

VIRGINIA.

How happy should I be to know the attributes of God.

THE MOTHER.

You will learn them by doing good according to his example.

VIRGINIA.

But I am too young to do good.

THE MOTHER.

You may do some good even at present; refrain from giving pain to animals; for an indulgent treatment of animals is the first step towards benevolence in regard to our own species.

VIRGINIA.

Oh! I can act a kind part to my little brother. You know that I have nothing I am not ready to share with him; here, my little Paul, are flowers gathered for you; here are violets and daisies; I will stick them all around your little cap.

THE MOTHER.

Come, my dear Virginia, it is time to go home, lest we should be overtaken by the night. You can make a chaplet of flowers for your brother at home; and in our way back we shall probably find your father coming to meet us.

I may safely assert that I have put nothing in this dialogue beyond the common ideas of my little girl at the age of four years and eight months. She has often puzzled me with her questions, such as "What purpose does that answer?" and "How has it been produced?"

After satisfying her on these points, she returns to the charge in a different shape; "And what if that were not the case?" She thus aims at ascertaining things both affirmatively and negatively, and has often embarrassed me with her inquiries. There is nothing unusual, however, in this mode of questioning: we shall find it in most children who have been brought up with any degree of liberty. Our reason seems affirmative and negative in its first display, being formed of contraries like the harmonies of Nature. It is this that prompts children to pluck the leaves off the rose, which they at first regarded with silent admiration; like men, they are anxious to know the source of their gratifications. Now I would make use of this instinct for the purpose of giving them an intimate knowledge of botany; I would show them the connexion of the roots of plants with the ground; of the leaves with rain; of the stalks with the wind; of the petals of flowers with the sun. I would explain to them even the use of the pistils, the anthers, and their sexual parts. Those images are pure in flowers, and I would not have young people be ashamed of their own sex. Every thing is innocent so long as our minds are innocent. It is not Nature that corrupts the heart, but the heart that corrupts Nature. My wish would be to teach children to

respect that double chain which serves to perpetuate a succession of beings, as a sacred law which Nature has impressed on them under the safeguard of modesty. Young females living in a savage state are chaste, however slightly clothed, because their hearts are pure; and the sexes of the plants would no more excite indelicate ideas in the minds of children, than the sexes of the animals whom they see passing daily before their eyes.

We are all sceptics by nature; the direct and indirect questions of children are a proof of it; and it is by these questions that they obtain instruction. With them, as with Descartes, doubt constitutes the first impulse to the acquisition of knowledge; and it is to the unsettled state of their information, that I ascribe those habits of change which are so natural to them. Their inconstancy is a balance which has its vibrations like the heart, and is in connexion with the harmonies of nature, which are made up of contraries. These variations render the youthful mind well qualified to acquire information in various departments, if we are careful to maintain an equilibrium. The misfortune is, that prejudice, authority, and habit, are apt to make it take a bias to one side to a degree which it is difficult to recover. Happy could we but accustom our-

selves to doubt and reflect on the opinions of other persons; but, like philosophers themselves, we are too apt to reject such opinions without examination, and to approve only our own.

It is consequently necessary to allow children to put questions; for it is the province of those who do not know, or who entertain a doubt, to ask; as much as it is the province of him who knows, or thinks he knows, to give an answer. This is just the opposite of our usual manner of teaching, as Rousseau has very properly remarked; all we have to do is to stimulate the curiosity of children, which is a very active feeling in them, because every thing is new to them, and their minds are at a loss on what points to fix. If we do not therefore discourage it by dogmatic authority, it will be easy to disclose to it a thousand attractive prospects in the midst of the endless variety of useful truths by which we are surrounded. But if, like Epicurus, you fix it on atoms; or, like Descartes, on a vortex of these atoms; or like Aristotle, on the horror of a *vacuum;* or on the love of a *plenum,* which is, in other words, the "attraction" of the Newtonians, you will soon make shipwreck of this inquisitive turn. It will be in vain for you to add to the last of these systems ingenious suppositions in regard to the combination of a pro-

jecting, along with an attracting, power, by way of accounting for the preservation of the different parts of the universe from being brought into a solid compound by the power of attraction. In vain you will reason in regard to this projecting force in a straight line being produced by the centrifugal force of the attracting body; in vain you will add that some bodies are repulsive as others are attractive; for you might with just as much truth say that it was in the nature of a lady to hate her admirer. Try what you will, you will never impress a clear idea of the elliptic and constant movement of a planet around the sun, without the accompanying idea of an intelligent being, the Creator, the preserver, and the director of the system. An impression of divine power is the ultimatum of human reason; it is the centre of that sphere of which reason is a radius; it takes its departure from it, and it returns to it. I have attempted a slight sketch of its commencements in displaying the workings of the mind in a little girl. Children of ten or twelve are capable of much more extensive reasoning; and some of them, by a few simple questions, would succeed in making the most tenacious atheist confess the existence of a God, in as strong terms as Newton himself.

The true way to keep our minds impressed

with the bounty of Providence, is to continue the study of flowers. If young girls are fond of flowers scattered throughout the fields, they are equally fond of gathering them in nosegays and chaplets; and of assorting them in a way suitable to their features and complexions. This affords a very good opportunity of giving them an idea of our theory of colours, and particularly of what are called the five primitive colours, viz. white, yellow, red, blue, and black. To these we might add the intermediate colours; such as saffron, orange, violet, indigo; and we might make with flowers a garland to represent a succession of the most pleasing harmonies in colour in the following arrangement: jessamines, daisies, jonquils, butter-cups, monkshoods, roses, poppies, corn-campions, blue-bottles, larkspurs, and dark-coloured tulips: for, as to flowers entirely black, I must confess I know of none such. They would be useless in the vegetable world, where every flower carries its shade along with it. We might, in like manner, teach young girls to make contrasts by means of flowers, by putting the light-coloured in opposition to the dark; I mean, by putting the whitest in the centre, as a mass of light for the purpose of giving whiteness and animation to the whole group. This plan we find followed by the Van Spandoncks in their

paintings. After all, however, these reflections of mine are not so good as the natural taste of the sex in arranging these flowers, which constitute their most attractive ornament. I knew a lady, who, out of mere grasses of different kinds, found the means of making a very pretty assemblage of colours in long-necked vases, without the intermixture of a single flower. The ladies of the East are said to find the means of exhibiting a picture of all their passions by assortments of roses, marigolds, and tulips. In fact, flowers have an evident connexion with character; some being cheerful, others melancholy; and some having even a relation to the features of the countenance; the blue-bottle with the eyes; roses with the mouth; the Guelder-rose with the bosom; the fox-glove with the fingers, &c. Each of these possesses a perfume connected in like manner with our different sensations of beauty. The best scented flowers, such as violets and roses, are fittest for nosegays and chaplets. Nothing is so delightful as flowers in the dress of women and children. Gold, silver, pearls, and diamonds are not to be compared to them, either in shape, or in colour, as they are generally too bright: flowers alone have a form and a tint correspondent to the colour of the eyes, the lips, and the countenance: they are to be gathered at any hour at

our feet, while precious metals and shining fossils are to be sought amidst a thousand dangers, and in a distant land. The one is gathered by the hands of innocence; the other, too often, by hands imbrued in crimes.

It does not, however, always happen that we enjoy the first charms of spring; for as human life is tinctured with disease, spring is sometimes introduced by frosts and sharp showers; the month of April is frequently moist and cold. The peasants in my native quarter have a proverb, "April is mild, but when it turns to bad weather it is the worst of any." There prevails, at that time particularly, on the coast of Normandy, a north-west wind, which covers our fields with the cold atmosphere of the sea-ice descending from the North Pole. The month of May is sometimes not much better than April. Voltaire was in the habit of saying that "May was fine only in the imaginations of the poets." I have more than once in the course of our walks seen snow fall along with the flowers of the horse-chesnut. Why should we then expose our little daughters to the danger of cold and of obstructed perspiration? Destined by their delicacy, as by their domestic duty, to keep the inside of the house, let us leave them there safe from the rage of the elements, which ought to be braved by

youths only. While the latter go out in all weathers to gather flowers and branches in the fields, let the young females be employed in making garlands, and in drawing or in embroidering flowers under the direction of their mother, or of some neighbouring matron.

The practice of making drawings of flowers seems to me highly instructive to children of both sexes. They will find curves of all kinds in their shapes; and they will thus exercise, on a regular model, that instinct which leads them to make rough sketches on walls of the various objects that strike them. I cannot help thinking that it was to plants, and particularly to their roots, which supply threads, strings, and bows, that savages are indebted for the first models of the spiral part of their furniture, and of their hieroglyphic writings. This seems the more probable, as the Chinese, the most ancient people on the surface of the globe, invented their first alphabet in this manner. According to Kircher, it was from the curves of roots, to which they ascribe the chief virtues of plants, that they composed their first letters, which served for the purpose of ordinary writing and of books. They joined to these in the sequel a variety of other letters, or alphabets, imitated from stars, birds' wings, tortoises, shells, worms, reptiles, fishes,

according to the particular subjects of which they wished to treat. Their practice was to group together several of these animals, for the purpose of expressing the character of a particular object. When desirous of conveying an idea of a stream rushing down like a torrent, they introduced several fish swimming backward and forward; the ordinary course of a stream was pourtrayed by a single fish swimming straight forward. A collection of animals formed, in ancient times, a character which the Chinese of the present day express by a point, or by a simple stroke; and in this, according to Kircher, lies the only distinction between their ancient and modern characters. They had, in the beginning, no less than sixteen alphabets; at present they have only one; but that which is connected with vegetation is the most ancient, and indeed the foundation of all the rest.

We ought, in my opinion, to ascribe to an imitation of the shape of roots those thin strokes which we find in the writing of the Chinese and of the other Oriental nations, who, no doubt, imitated similar models. We may probably trace these radical characters in our Roman letters; for the three legs of the M, the two perpendiculars of the N, the two slopes of the A, the two inversions of the V, X, Z, &c., bear a re-

semblance to the vegetable roots of the Chinese alphabet. The letters E, F, I, L, Y, represent perhaps the trunks of trees, some entirely bare, others with branches, and others with roots. Our T, in particular, is known to be an abbreviation of the famous *tau* of the Egyptians; and was intended as an imitation of the trunk of a tree with its horizontal branches. This, in the Chinese alphabet, was drawn †, the resemblance of which to the form of a cross suggested a variety of observations on the part of our missionaries, who looked on it, as well as on the Egyptian *tau*, as taken from the Christian symbol of redemption. Travellers, however, consider it as the figure of a tree in the Chinese alphabet. It seems likely that our S was imitated from the figure of a serpent, particularly as it has on all occasions a hissing sound. An appropriate illustration of this is to be found in the line put by Racine into the mouth of Orestes, when in his delirium he imagines that he beholds the bloody spectre of that mother whom he has put to death:

Pour qui sont ces serpens qui sifflent sur vos têtes?

The letter C has a part of the shape of the S, or of a serpent half raised from the ground; and it has frequently the same hissing sound. As to

the O, I am inclined to think that its shape is taken from that of the sun, particularly as the sound expressed by it, in all languages, is that of admiration; a sentiment likely to be produced among every people by the appearance of the orb of day. The O gives a kind of sonorous majesty to all words, and is frequently found in the southern languages of Europe, particularly in the Spanish. The Emperor, Charles V., when speaking of the different accents of European languages, was in the habit of saying, that English was fit to be spoken to birds, German to horses, Italian to ladies, French to men, and Spanish to God. The letter O occurs very frequently in the simple dialects of the inhabitants of the torrid zone; and confers on them a harmony and a dignity which is often wanting in the languages of civilized nations in other climates. This is exemplified in the names of most of the kingdoms of the interior of Africa, such as Angola, Majombo, Gingiro, Macoco, Loango, Congo, Loando, Monomotapa, Monzambo, &c. On the other hand, I have observed that in cold countries, such as Russia, the terminations of words are frequently in A; as in the case of the lake "Ladoga" in Finland; of the cascade of "Imatra;" and of a variety of names of ordinary occurrence; beer being called piva; water, vauda;

bread, gleba; mother, matouska; father, batouska. To turn to the left they say, na lava; to the right, na prava; my pigeon, goloubouska, mäïa, &c.

Of the sixteen Chinese alphabets, six are said to have been discovered by their early emperors. Fohi composed for astronomy that which is called the dragon alphabet, on account, no doubt, of the nature of the figures introduced into it; Xim-Nûm composed the agricultural alphabet; Chuem-Kim that which is chiefly made up of the imitations of the shape of oysters and worms. Choam-Ham the one formed from the figures of birds; and Yao that of tortoises. From these inventions being ascribed to crowned heads, one is led to infer that, in those ancient days, either sovereigns were philosophers, or that philosophers became sovereigns. The first generations of mankind not only endeavoured to express their ideas by natural signs, as we see in the primitive written characters; but they had recourse likewise to a figurative style, which the savages, and nations in the east not altogether in a savage state, employ at the present day to describe their passions, their laws, and their duties. This is an additional authority for me, in regard to the necessity of seeking the origin of moral harmonies in the harmonies of nature. The products of

the vegetable kingdom are, no doubt, the favourite objects of attention in figurative composition; and, I may venture to say the same generally, of whatever relates to the acquisition of taste and judgment in our habitual occupations. I have already mentioned the remarkable circumstance, that a person employed to draw ornamental figures on Lyon's manufactures, who learned botany by the advice of Rousseau, became in consequence one of the most eminent persons in the exercise of the business.

How great must be the satisfaction of a mother on observing her children imbibe, at the sight of the riches of the vegetable kingdom, those sensations of enthusiasm which form the sure foundation of ultimate attainments. Among the young females, some take a pleasure in drawing, painting, and embroidering flowers; while others discover the means of extracting essences from them. Among youths, some are occupied with the task of arranging them; while others find, in their beautiful curves, fit objects of imitation by the pen or pencil. The reflecting power of flowers conveys warmth without the hazard of kindling a flame; and is consequently a subject of greater interest than the mirrors of Archimedes. No study is more happily calculated to relieve us, throughout the course of life, from

the influence of those passions which are engendered by the want of legitimate objects of application. Such a study offers inexhaustible amusement when in the possession of fortune, and an assured consolation in the day of indigence. Among the unhappy emigrants from France, how many respectable females have been indebted for their independence and support to ornamental needle-work; while their brothers and husbands found only slavery or death in the destructive profession of arms? Some there are, no doubt, among the latter, who, after being stripped of all they held dear by the impious system cherished at one time in our cities, and after cursing in despair the human race, have found their minds opened to devotion and benevolence on contemplating the enchanting works of the Author of Nature. They found again a country, although they had lost their fellow-citizens; and they found a God where they conceived humanity to be extinct. The grass of the meadow offered them a resting-place, and the summits of the forests raised their eyes and their soul towards heaven. Plants loaded with fruits and flowers are scattered over the surface of the ground, like islands in the middle of stormy seas, to afford us refreshment in our passage, and to guide our steps towards another world.

After having pointed out to children the principal parts of plants, and taught them to group, to draw, and even to describe them, it is useful to exhibit them in a connected view, that they may acquire the power of making comprehensive sketches or delineations of them. Many persons have a difficulty in giving any other account of their travels than by the signs along the great roads, or the names of the inns, towns, and villages, which they have passed by the way. They can hardly tell you whether they have gone to the east, the south, or the west. They pass through meadows, vallies, and forests, without being aware of their beauty, for Nature has no attraction in their eyes. The products of the vegetable kingdom, tho' grandest ornament of a country, are lost upon minds absorbed in selfish calculation. Even our agriculturists are in the habit of seeing nothing but bundles of hay in our flowery meadows, and sacks of corn in the undulating fields of the gentle Ceres. The most majestic forest presents to them merely faggots and fire-wood, and excites their attention only when cut down and placed in regular rows. Yet it is from the harmonies of the vegetable kingdom that those arts which constitute the charm of our existence derive their principal attraction. Poetry, eloquence, morality itself, all delight us by the

images obtained from this source. The sacred volume, austere as it is in the lessons which it inculcates, affords us the highest delight by the figures introduced from natural objects into its style. I have myself counted above a hundred emblems taken from agriculture in the writings of a single evangelist.

I shall now endeavour to lay down a few rules to teach children to express in painting, in verse, or in prose, the sensations excited in them by natural objects. I shall address myself to their eyes before attempting to speak to their hearts. The method to be followed in making a good landscape is the same as that which I have pointed out as suitable to describe the nature of plants. Our first endeavour should be to exhibit the harmonies between the landscape and the elements, in the same way as we have exhibited those of plants with the latter. We begin, for instance, by expressing the power of the sun on the horizon; a landscape without a sun is like a vegetable without a flower. As no pencil can describe the orb of day in all its splendour, we must either have recourse to some object as a shade, or make choice of the hours when its light is not brilliant. The most favourable time is morning or evening, because the sun being then on the horizon, the different objects in our paintings receive his rays in

a line parallel to our eyes, and are detached from each other by extensive shades.

The evening appears to me preferable to the morning, because the sky having then a greater portion of vapour, the effect of the light is rather more conspicuous. Evening likewise announces to the mind approaching repose, while morning is a notice of the beginning of labour. Claude Lorraine preferred the light of the setting sun for his landscapes, and he has excelled in exhibiting its reflection on the sky and on the sea. His vessels, his palaces, his peristyles, shine in all the beauty of a yellow atmosphere. But I cannot help thinking that the horizontal rays of the setting sun would produce a still finer effect upon the trees of the forests, were the artists, after having exhibited the purple tint on the lower foliage, and the gilded appearance of the verdant summits, to paint the rays striking on the moss-covered trunks, and giving them the appearance of pillars of bronze.

The atmosphere should likewise be exhibited in a landscape by a lofty sky, the distant part of which should be marked by rising and fugitive vapours. The clouds surrounding the setting sun ought in particular to be rendered expressive of the great extent of the horizon by a lively colour, and a marked shade in those which are farthest.

forward in the picture; while the clouds which follow them should be painted in deadened colour and shade, as if about to disappear in the immensity of the sky. The wide extent of the air should likewise be expressed by the long perspective introduced among the trunks of trees, and by a few glances at an azure sky exhibited through their branches. It is in this way that Jouvenet has painted in the midst of woods a profound solitude of Bruno the founder of the Carthusians. We might perhaps succeed in conveying an idea of the motion of the air, the soul of vegetable life, by the vibration of the tops of trees, the inversion of their foliage, and the undulation of meadows. It might be practicable to add a farther aërial harmony by delineating a fall of rain, without however extending it over the whole painting, which would in that case be rendered as gloomy as the delineation of the deluge by Poussin. All that is wanted is to convey the effect of a rainy cloud on a part of the forest; the mixture of the rain and sunshine forming rainbows in the sky, and delightful harmonies among the trees.

A landscape without water is like a palace of Venus without a mirror. In my opinion, the proportion of water to land in a landscape should be as two to one, always observing that terraces

in a painting, such as hills and mountains, ought to re-gain in height what they lose in surface. These observations are exemplified in the case of our globe, where the extent of water predominates greatly over that of land, at the same time that the latter acquires by its inequalities a considerable addition to its superficial extent. The adoption of the plan I have ventured to suggest gives rise to an exhibition of striking reflections from the water on the land; hence the beauty of islands in a landscape. Poets have long since fixed on an island as the birth-place of the goddess of love; and the Chinese, who appear to be fully alive to the effects of the introduction of water in painting, make their goddess Amida and her child arise from the bosom of a flower in the middle of a lake. The most pleasant situation for an island, in my opinion, is at the conflux of rivers, as it then stands in the midst of several streams of water; or at the influx of a river into the sea, where a contrast is produced between the colour of the fresh, and the azure of the salt water. It is on the banks of rivers that the riches of the vegetable kingdom are displayed in all their beauty, not only because they are larger, and more fully in flower than in other situations, but because they are there reflected in all their splendour. At sun-set in particular, the

image of a plant is exhibited as completely as the original in the bosom of the waves. The landscape appears double; there is a real and an imaginary one. On one hand, we see a forest joined by its extremity to a similar forest. On another side, a bridge forms a second bridge with its own image, and makes its arches into complete circles. We behold at the same time two skies, two suns, and the one at the bottom of the deep is not less brilliant than the one which shines with splendour on high.

The earth, in its turn, offers new combinations by the colour of its terraces, whose dark rocks and dusky hue harmonize so well with the surrounding verdure. But it is, above all, in its deep vallies, and in its mountains with smooth sides and steep summits, that the earth offers the most magnificent amphitheatres for the riches of vegetation. We there see every different tribe arranged in its place, from the green-reed, which the breath of the zephyr shakes beside the water at the bottom of the valley, to the cedar which rises through a purple atmosphere around the glaciers of distant mountains, braving the fury of tempests and the rigour of winter. Nothing adds more to the majestic appearance of a landscape than the introduction of trees.

It would be in vain to expect beauty in a

landscape, without a display of some part or other of the vegetable kingdom. The name of landscape cannot with any propriety be given to the sandy deserts of Africa, the snows and glaciers of the North, or the rocks and shoals of Spitzbergen. On the other hand, we shall succeed in making a very attractive landscape in a plain, however limited, by a judicious division of different plants. Grasses, shrubs, trees, may be there arranged like an amphitheatre, and convey the idea of vallies, eminences, waters, rocks, and precipices. Each tree may be made to delineate a particular character, and, in some measure, to express a passion. The dark and bristly yew has a hideous look; while the cypress and the willow of Babylon convey the impression of melancholy. The rose-tree seems the emblem of pleasure by the transient and brilliant nature of its flowers, mixed as they are with concealed and permanent thorns; while the myrtle is indicative of voluptuousness by its flexible or odoriferous branches. The oak conveys the impression of strength by its knotty trunk, while the majestic pine resembles a tall rock erected on a mountain, and the poplar with its trembling leaves appears to imitate the motion of the water. A variety of natural harmonies is produced by the contrast of different vegetables with each other; such as that of the

lilies and roses; that of the water-bindweed with cordate leaves and white bell-shaped flowers, called *chemises de notre dame;* the yellow flowered ebony with the dark and tapering fir; the vine and elm. * * *

The introduction of animals is likewise calculated to increase the impression produced by the vegetables with which they are connected in the arrangements of Nature. Every tree and every plant may be said to possess a living part in its feathered tenant which goes, returns, sings, or murmurs, around it. The bee is in this kind of relation with the cytisus; the butterfly with the rose; the amorous turtle-dove with the myrtle. The owl builds his nest in the church-yard yew; the squirrel, clothed in fur, in the pine of the North; and the plaintive nightingale in the rustling poplar. Virgil was fully impressed with these relations, and particularly with the last, when he compared Orpheus lamenting the loss of Eurydice to a nightingale deploring, under the shades of a poplar, the seizure of its unfledged young by the hands of a merciless countryman:

Qualis populeâ mœrens philomela sub umbrâ
Amissos queritur fœtus, quos durus arator,
Observans nido, implumes detraxit: at illa
Flet noctem; ramoque sedens, miserabile carmen
Integrat; et mœstis lat[illegible] loca questibus implet.

Translated by Dryden.

So, close in poplar shades, her children gone,
The mother-nightingale laments alone,
Whose nest some prying churl had found, and thence,
By stealth, convey'd th' unfeather'd innocence.
But she supplies the night with mournful strains;
And melancholy music fills the plains.

The poet contrasts very happily the grief of the distracted mother with the cruelty of the plunderer; and the beauty of this passage is completed by that resemblance of sound to sense, which it would be in vain to expect in a prose translation.

Virgil compares the conjugal love of Orpheus to the maternal affection of the most harmonious of birds, as the only one capable of expressing sufficiently the extent of his grief. He felt that illustrations drawn from human passions had the effect of giving a character of sympathy to particular plants, and we consequently find him coupling frequently together children and roses, youths and lilies, young girls and myrtles. How gracefully does he introduce in his Eclogues the vintager singing on the top of the elm, the prop of the vine. For my part, I find an additional interest on seeing the willow support by the river-side the fisher-

man's osier-net on branches similar to those of which it is constructed. If I prefer to it the willow of Babylon, it is from recollecting that it was on it that the Israelites hung their harps in the day of captivity. The greater the moral harmony between men and plants, the more striking the effects arising from it. My soul expands on contemplating across the fields those extended roads which establish a communication between empires: many persons see nothing but the trees on each side; but I am impressed with the recollection of the various differences in the character of mankind. On the one hand, I trace the road to that delightful Italy which has shared in the tumults of our revolution; on another, the road to Switzerland, which has likewise felt our troubles; to the right I have Spain, the country of the chivalrous Cid, and of the ill-starred Cervantes; and to the westward, I fix my eye on Brittany, where I embarked for the Isle of France, full of philanthropic zeal, but destined to encounter a host of opposition. In a different direction are the roads of Russia and Poland, the abodes of my youthful years, and the scenes of my unpropitious loves.

Let me abstain, however, from personal allusions, and confine myself to physical illustrations. Poetry has a great advantage over painting in the

description of a landscape, by addressing the soul, while her sister art appeals to the eye only. At the same time I am very far from joining in the unkind opinion, that painting is no better than a feeble and dumb companion to poetry. They are governed by kindred laws, and great painters are as rare as great poets. If painting is inferior to poetry, it may proceed from our being obliged to look out for the harmonies of the different objects introduced into it; while poetry places them in a manner before our eyes. Painting, moreover, gives only the exhibition of a single event, or a single point of view; but poetry displays various scenes in succession; scenes calculated to produce lively and durable impressions. This is the reason that no painting of Poussin has called forth those tears which flow at the verses of Racine. Sculpture, although exhibiting the relievo of objects, labours under a similar disadvantage. The description of Laocoön in Virgil is unquestionably more affecting than the admirable piece of art which represents the unhappy father grouped along with the serpents who are devouring his children. Still it is undoubted that more time and labour were required to make the painting of the Deluge than the most pathetic scene of Andromaque; or to sculpture the group of Laocoön, than to compose

the verses of Virgil. Poetry is indebted for its advantages over painting to the harmonies of objects which it is enabled to exhibit more feelingly, by detaching them and expressing their modulations in succession.

As it oftener happens that we give an account, written or verbal, of the countries we have visited, than that we either draw or paint them, I proceed to exhibit a few examples of the rules followed by the best poets in their descriptions of vegetable products and landscapes. These rules are equally applicable to poetry and to prose; for they are derived from Nature herself. The following verses of Quinault may serve as a favourable specimen of the florid style:

Ce fut dans ces jardins où, par mille détours,
Inachus se plait à prolonger son cours;
Ce fut sur ce charmant rivage
Que sa fille volage
Promit de m' aimer toujours.
Le zéphyr fut témoin, l'onde fut attentive,
Quand la nymphe jura de ne changer jamais;
Mais le zéphyr léger et l'onde fugitive
Ont bientôt emporté les serments qu' elle a faits.

In this smiling landscape, air, water, earth, and gardens, all harmonize according to the laws which we have already laid down; running water, in particular, forms a prominent feature in the

description. The poet makes a very pleasant combination of the windings of the river, the lightness of the zephyr, the fluidity of the wave, and the vows of the inconstant nymph. This description is full of the reflection of physical as well as moral objects; but, with all its beauty, it does not speak to the heart. Its colour is brilliant, but without heat; and it contains not a ray either of the sun or moon, the introduction of which gives in general so much interest to a love-tale. I should have liked also to have seen some shade in this exhibition, and would have introduced a thicket on the margin of the stream, for the sake of effect and variety. But Quinault will be thought to have judged better in studying the consistency of the subject with the figures employed to delineate it. He is a graceful writer; and Voltaire acted very properly in re-establishing his reputation, attacked with too much asperity by the severe Boileau.

Notwithstanding this favourable opinion of Quinault, I am induced to rank our inimitable La Fontaine greatly above him: The manner of the latter has more colouring, truth, and variety. Quinault may be said to have confined himself, in point of subject, to love and its wanderings; to which he opposes the wanderings consequent on the passion for military fame; a passion of

almost equal danger. La Fontaine, on the other hand, has treated of almost every subject in every manner. He is a moral poet, *par excellence;* he is also a sentimental poet. His verses contain an antique and Attic tincture which it is difficult to describe, and still more difficult to find elsewhere. They are children of Nature as much as the objects of which they exhibit a description: time, far from putting them out of date, has added to their beauty; they give greater pleasure under apparent negligence, than other verses in all the pomp of elegant composition. To have an idea of the superiority of his manner over that of Quinault, we have merely to compare the landscape quoted above, with that which is contained in the Fable of the Oak and the Reed:

Le chêne, un jour, dit au roseau:
Vous avez bien sujet d'accuser la nature;
Un roitelet pour vous est un pesant fardeau,
Le moindre vent qui, d'aventure,
Fait rider la face de l'eau,
Vous oblige à baisser la tête:
Cependant que mon front, au Caucase pareil,
Non content d'arrêter les rayons du soleil,
Brave l'effort de la tempete.
Tout vous est aquilon; tout me semble zéphir
Encore si vous naissiez à l'abri du feuillage
Dont je couvre le voisinage,

Vous n' auriez pas tant à souffrir,
Je vous défendrois de l'orage;
Mais vous naissez le plus souvent
Sur les humides bords des royaumes du vent.
La nature envers vous me paroît bien injuste!
Votre compassion, lui répondit l'arbuste,
Part d'un bon naturel: mais quittez ce souci;
Les vents me sont moins qu' à vous redoutables;
Je plie, et ne romps pas. Vous avez jusqu' ici,
Contre leurs coups épouvantables,
Résisté sans courber le dos;
Mais attendons la fin. Comme il disoit ces mots,
Du bout de l'horizon accourt avec furie
Le plus terrible des enfans
Que le nord eût porté jusque-là dans ses flancs.
L' arbre tient bon, le roseau plie;
Le vent redouble ses efforts,
Et fait si bien qu' il déracine
Celui de qui la tête au ciel étoit voisine,
Et dont les pieds touchoient à l'empire des morts.

La Fontaine represents all the powers of nature in action in this landscape. We have here the sun, the wind, the water, a storm, a high mountain, an oak, a twig; and, finally, a *roitelet*, or wren, a member of the animal kingdom. There is no doubt, had his subject, like that of Quinault, admitted the introduction of a human personage, and particularly of a nymph, that the picture would have been more interesting. In the absence of a living personage, he perso-

nifies two inanimate actors; giving the oak a front like Caucasus, a back which never bends, a head stretching towards heaven, and feet extending downwards to the region of the dead. The sentiments applied to this personified object are perfectly suitable to its stature, being disdainful compassion and the pride of conscious superiority. He puts in contrast a feeble reed, shaken by every wind, but humble, patient, content with its lot, and finding its safety in its very weakness. The poet then assumes a loftier strain, and gives dignity to the picture by images of distant objects. He introduces the marshes, the humid frontiers of the kingdom of the winds, and he exhibits the wind itself in a personification:

Du bout de l'horizon accourt avec furie
Le plus terrible des enfans
Que le Nord eût porté jusque-la dans ses flancs.

At last arrives the catastrophe intended as a perpetual lesson to great and small. The moral of this fable is not explained in the shape of a maxim in the beginning or end, as is customary in the other fables of La Fontaine; but it is scattered throughout, which has a much better effect. It is the reader, and not the author, who in this case, deduces the conclusion. When a moral is mingled with fiction, the latter may be

said to resemble those stuffs in which silk and gold are interwoven. In the present case, the moral is indicated in the description of the last figure; for the words will be found equally applicable to the towering oak, as to the grandees of the world frequently overthrown by slight causes:

Celui de qui la tête au ciel étoit voisine,
Et dont les pieds touchoient à l'empire des morts.

This philosophic fable is almost the only one in which La Fontaine has thought proper to introduce two objects belonging to the vegetable kingdom. From his manner of exhibiting them, it is plain that he would have been at no loss for the emblems of every human passion in plants and trees, the characters of which are so greatly varied. He often takes images from among dead or inanimate objects; such as a file, a mountain, the winds. He says himself, in his Fable of the "Bear and the Amateur of Gardens:"

Les jardins parlent peu, si ce n'est dans mes vers.

On looking over his different fables, I am at a loss to find any characters taken from the vegetable tribe, except the two mentioned above, and the tree in the fable of "the Man and the Serpent." Animals, it is true, supplied him with

an abundant stock of characters, more analogous to ours and of a more determinate cast. Be this as it may, he has not failed to enrich his poetry with all the charms which the treasures of nature, and particularly of the vegetable kingdom, afforded him in regard to description. It is no exaggeration to say that he has added a landscape to every fable; a taste acquired by the study of the ancient poets, particularly Virgil. The celebrated Roman has a great number of these landscapes, not only in his Bucolics and Georgics, but in his Æneid; having taken Homer for his model in this as in other respects: and with great propriety, an Epic Poem being nothing but a comprehensive representation of nature. By way of conferring animation and solemnity on their descriptions, both poets have given a character of divinity to the different kingdoms of Nature.

I find myself induced to turn aside at present from the direct object of my reasoning, and to make a few observations on Virgil's Eclogues, in the hope of giving my young readers a foretaste of the works of the prince of Latin poets, and of creating in them a desire to study these works in the original language. These observations will have the effect of showing that Virgil succeeded in giving interest to his descriptions, in a great

measure, by displaying those general harmonies of which we have laboured to demonstrate the existence. In his first Eclogue he introduces the unfortunate Melibœus, stripped of his patrimony by civil war, and obliged to fly from his native country, at the side of Tityrus reclined under the shade of a spreading beech, and wholly occupied with singing the praise of the fair Amaryllis:

> Tityre, tu patulæ recubans sub tegmine fagi,
> * * * * * * * *
> Formosam resonare doces Amaryllida sylvas.
>
> Beneath the shade which beechen boughs diffuse,
> You, Tityrus, entertain your silvan muse.
> * * * * * * * *
> And Amaryllis fills the shady groves.

I will not dwell on the contrast in the situation of the two shepherds, notwithstanding the interest it confers on their dialogue; particularly when we recollect that Virgil has pourtrayed his own situation, or rather that of his father, under the name of Tityrus. Confining myself to the principal sketches in his landscapes, I find that, after introducing in the foreground of his picture an ample beech-tree in the neighbourhood of a forest, he places around, rocks, meadows, water, air; to all which he adds the sentiment of a superintending Providence, and a crowd of gentle

and tender feelings, extracted from rural images, and originally derived from objects in the animal kingdom. His description is rendered much more affecting by being put into the mouth of the unfortunate Melibœus, robbed of his paternal domain. He is introduced as saying to the fortunate Tityrus:

Fortunate senex! ergo tua rura manebunt;
Et tibi magna satis, quamvis lapis omnia nudus,
Limosoque palus obducat pascua junco.
Non insueta graves tentabunt pabula fœtas,
Nec mala vicini pecoris contagia lædent.
Fortunate senex! hic inter flumina nota
Et fontes sacros, frigus captabis opacum.
Hinc tibi, quæ semper vicino ab limite sepes
Hyblæis apibus florem depasta salicti,
Sæpe levi somnum suadebit inire susurro.
Hinc altâ sub rupe canet frondator ad auras.
Nec tamen interea raucæ, tua cura, palumbes,
Nec gemere aëria cessabit turtur ab ulmo.

O fortunate old man! whose farm remains—
For you sufficient—and requites your pains;
Though rushes overspread the neighb'ring plains,
Though here the marshy grounds approach your fields,
And there the soil a stony harvest yields.
Your teeming ewes shall no strange meadows try,
Nor fear a rot from tainted company.
Behold! yon bord'ring fence of sallow trees
Is fraught with flow'rs, the flow'rs are fraught with bees:
The busy bees, with a soft murmuring strain,
Invite to gentle sleep the lab'ring swain.

While, from the neighb'ring rock, with rural songs,
The pruner's voice the pleasing dream prolongs,
Stock-doves and turtles tell their am'rous pain,
And, from the lofty elms, of love complain.

Tityrus, in attributing to Augustus the preservation of his patrimony, adds to his landscape the following illustrations:

Ante leves ergo pascentur in æthere cervi,
Et freta destituent nudos in littore pisces;
Ante pererratis amborum finibus, exul
Aut Ararim Parthus bibet, aut Germania Tigrim,
Quam nostro illius labatur pectore vultus.

Th' inhabitants of seas and skies shall change,
And fish on shore, and stags in air, shall range,
The banish'd Parthian dwell on Arar's brink,
And the blue German shall the Tigris drink,
Ere I, forsaking gratitude and truth,
Forget the figure of that godlike youth.

Virgil, having, in the lines last quoted, opposed to the natural landscape so well described by Melibœus, a picture of a very different kind by Tityrus, brings forward images of a new and strange character, though unfortunately too probable in the prospects of the future as it strikes the unfortunate Melibœus:

At nos hinc alii sitientes ibimus Afros:
Pars Scythiam et rapidum Cretæ veniemus Oaxem,
Et penitùs toto divisos orbe Britannos.
En, unquam patrios longo post tempore fines,
Pauperis et tuguri congestum cespite culmen,
Post aliquot, mea regna videns, mirabor aristas.
Impius hæc tam culta novalia miles habebit?
Barbarus has segetes? En, quo discordia cives
Perduxit miseros! en, queis consevimus agros!

But we must beg our bread in climes unknown,
Beneath the scorching or the freezing zone:
And some to far Oaxis shall be sold,
Or try the Lybian heat, or Scythian cold;
The rest among the Britons be confin'd;
A race of men from all the world disjoin'd.
O! must the wretched exiles ever mourn,
Nor, after length of rolling years, return?
Are we condemn'd by Fate's unjust decree,
No more our houses and our homes to see?
Or shall we mount again the rural throne,
And rule the country kingdoms, once our own?
Did we for these barbarians plant and sow?
On these, on these, our happy fields bestow?
Good heaven! what dire effects from civil discord flow!

By this contrast Melibœus heightens the beauty of his native landscape, and gives it a double interest by regretting his past happiness. Tityrus, by way of consoling him, invites him to pass the night in his cottage, and to accept there of a rural repast:

Hic tamen hanc mecum poteris requiescere noctem
Fronde super viridi: sunt nobis mitia poma,
Castaneæ molles, et pressi copia lactis.
Et jam summa procul villarum culmina fumant,
Majoresque cadunt altis de montibus umbræ.

This night, at least, with me forget your care;
Chesnuts and curds and cream shall be your fare:
The carpet-ground shall be with leaves o'erspread;
And boughs shall weave a cov'ring for your head.
For see, yon sunny hill the shade extends;
And curling smoke from cottages ascends.

Here the poet throws a light on his picture by introducing the last rays of the setting sun; or rather, as the subject is melancholy throughout, he confines his delineation to the shade and the approach of the nocturnal cold, as announced by the condensation of the smoke. He not only points out the time of day, but the month of the year, which must have been nearly our October, the season when apples and chesnuts are gathered in Italy, and a stock of cheese laid in for the winter. He even indicates the position of the spot, which must have been near the Appennines, if I may judge from the last verse:

Majoresque cadunt altis de montibus umbræ.

When a landscape contains nothing but the primitive powers of Nature, it must necessarily

have a character of complete solitude, and even a tint of melancholy, however pleasant it may be in other respects. This we shall find exemplified on merely turning up an occasional passage in which Virgil describes the relations of particular trees to particular situations. Look for example at the following verses in the seventh Eclogue:

> Fraxinus in sylvis pulcherrima, pinus in hortis,
> Populus in fluviis, abies in montibus altis.
>
> The tow'ring ash is fairest in the woods;
> In gardens pines, and poplars by the floods.

Although we have here none but physical contrasts, the poet has attained a kind of novelty by putting each plant in the singular, and its situation in the plural, for the sake of giving magnitude to his horizon. Had the vegetables been in the plural and their situations in the singular, the latter would have by no means had a character of such comprehension;—had he said, for example, "Oak-trees are beautiful in a wood; pines in a garden; poplars on the border of a river; firs on the top of a lofty mountain."

He paints, as an artist would say, with still greater *breadth* when he puts both the trees and their situations in the plural, as in the following verses of the Georgics, book ii. l. 110:

Fluminibus salices, crassisque paludibus alni
Nascuntur; steriles saxosis montibus orni:
Littora myrtelis lætissima: denique apertos
Bacchus amat colles, aquilonem et frigora taxi.

The sallow loves the wat'ry ground, and low:
The marshes, alders: Nature seems t' ordain
The rocky cliff for the wild ash's reign;
The baleful yew to northern blasts assigns,
To shores the myrtles, and to mounts the vines.

Trees are here contrasted with trees, and situation with situation, for the sake of augmenting the effect, as in the preceding example the ash was contrasted with the pine, the poplar with the fir, woods with gardens, and rivers with mountains. In the present case he contrasts the light-shaded willow with the thick foliage of the alder, the elm with the myrtle, the vine with the yew. He pursues the same course with their respective situations, opposing rivers to stagnant marshes, mountains covered with rocks to the sand of the sea-shore; eminences finely exposed to the sun, to bleak hills beaten by the winds of the north. He makes the trees harmonize with their landscapes for the sake of giving extent to the perspective; for grace and capaciousness arise from a succession of harmonizing objects, in the same way as a marked character is formed by contrasts. The ash has, from its colour, a certain analogy

with a wood; a pine with a garden; a poplar, from its rustling leaves, with the course of a river; and a tapering fir with a lofty mountain. The acanthus has, from the nature of its green, a certain affinity with the azure of water; the barren elm, with rocks; the myrtle, the shrub of Venus, with the margin of that element which gave her birth; the vine, winding in a semicircle, with the curves of eminences; and the bristled yew with the frosts of the north.

We shall treat more fully of such contrasts and correspondences when we come to speak of moral harmony: at present suffice it to observe that the want of animated beings in an extensive landscape throws a kind of sublime melancholy over it. We imagine ourselves to be alone with God and Nature, an impression often experienced by me in my solitary walks. I endeavoured to convey it in the landscape which serves as a frontispiece to my pastoral of Paul and Virginia, as a kind of prelude to the characters and misfortunes of those ill-starred lovers. To produce this effect, I introduced in it some specimens of man's workmanship, Port Louis at a distance, and some ruined cottages in the neighbourhood; but I should probably have made it more wild and romantic, had I introduced only the primitive powers of Nature.

Virgil, who had a different object in his Eclogues, makes a point of bringing forward animated beings in all his landscapes, for the sake of conferring life and movement on them. He brings in bees, grasshoppers, birds, flocks, and even gods. It is singular that among his different personages he should introduce no shepherdesses: their loves are often alluded to, but they personally are always behind the scene. The reason shall be given by and by, though I am not aware that any of his commentators have turned their attention to this topic, notwithstanding all the pains they have bestowed in dissecting his text in every possible shade. With all my veneration for the name of Virgil, I have no hesitation in saying that, by excluding females, he deprives his Eclogues of their greatest attraction. The most interesting of all known harmonies are those of the two sexes, either as brother and sister, as lovers, as joined in matrimony, or as parents. Gessner felt this, and found in such delineations a great source of attraction for his pastorals, which in other respects are much inferior to those of Virgil, particularly in the colouring, and in the touch of the descriptive pencil.

At the same time, I cannot find in my heart to pass sentence on a poet of so much judgment and feeling, without endeavouring to find a reason

in justification of the course he has pursued. How could there be a want of taste in the choice and *ensemble* of his objects, when so much is displayed in the detail? Why has he, who pourtrays in the Æneid, in the midst of warriors, all the charms of Venus and the impassioned love of Dido, abstained from bringing forward females on the scene where shepherds are employed in singing their loves? I can account for this only by the manners of his age and country, which made it a rule to separate boys and girls in the course of education. The consequence was frequently the formation of Platonic attachments of an awkward character, as we have seen among ourselves at boarding-schools, convents, and colleges. Virgil himself experienced the inconveniences of too great retirement in bringing his talents into action, for he was naturally so modest as to be called by the surname of the "Maiden." He could hardly speak without experiencing embarrassment, a characteristic which we may always set down as indicative of a high degree of sensibility. Accordingly when on growing up his mind sought an object of attachment, it was directed not towards the fair sex whom he had hardly seen, but towards youths, the companions of his studies. In an early period of life the heart is apt to feel towards a friend as towards a

mistress, and such was for a considerable time the situation of this amiable poet. His sympathy was at first excited by the misfortunes of his father, who had lost his property, and whom on its subsequent recovery he delineated, in his first Eclogue, under the name of Tityrus. The restitution of the paternal lands having tranquillized those early emotions, his mind became open to those impressions which are so beautifully described in his second Eclogue, entitled Alexis. These verses are full of the most melting melancholy; but they are after all only a monologue, in which the poet finds fault with himself for his misplaced attachment. The third Eclogue is different, and exhibits an example of attachment to the fair sex on the part of two shepherds who contend for the prize of the song. They begin by abusing each other, but they soon bring in the objects of their affection as the subject of their verses. Damœtas, after invoking Jupiter, sings, in succession, Galatea, Phyllis, Iolas, and ends by a eulogy on Pollio. Menalcas, on the other hand, invokes Apollo, celebrates Amyntas, Phyllis, Iolas, returns to Amyntas, and, after having likewise celebrated Pollio, pours out some abusive expressions on Bavius and Mœvius. Love in these two shepherds is nothing but a temporary fire which passes from one sex to

another, and from the gods to a patron of the candidates. The fourth Eclogue is a monologue in which the poet, in the view of making his court to Augustus, celebrates the birth of his son Drusus. The fifth is a model of elegiac poetry, and contains, under the name of Daphnis, the death and apotheosis of some great personage with whose name we are not acquainted. In the sixth Eclogue Virgil returns to the topic of love, and now ventures to approach the fair sex by exhibiting old Silenus in the midst of nymphs who bedaub him with the juice of mulberries. The seventh contains another dispute between two shepherds, Corydon singing the praises of Galatea and Phyllis; while Thyrsis celebrates Galatea and the beautiful Lycidas. Here the superiority is declared to rest with Corydon who has eulogized females only. In the eighth Eclogue love forms the sole topic, and, after a beautiful preamble, we find the remarkable expression—

Nunc scio quid sit amor.

Now know I what is love.

Female characters are now in a manner introduced, though not, it must be confessed, in a prominent point of view. Alphesibœus places, in a dialogue with other females, a shepherdess

distracted by love, and eager to bring back by magic arts the object of her attachment. The ninth Eclogue treats of nearly the same subjects as the first, but the tenth contains a most affecting description of the unhappy attachment of Gallus to an inconstant female. In his subsequent works, Virgil has given ample proofs of his sensibility in this respect, particularly in the episode of Orpheus and Eurydice in the Georgics, and still more in the Æneid, where he has painted the attachment of Dido in such animated colours. Although shepherdesses do not personally come forward in the early Eclogues of Virgil, it is to an attachment to them that the shepherds owe the animation of their songs, and the poet the interest of his composition. They shine like those celestial bodies which spread life and warmth over a landscape; and Virgil derives from them a number of half tints as a colouring in the description of vegetable products. In his seventh Eclogue Thyrsis is made to repeat the lines already quoted:

> Fraxinus in sylvis pulcherrima, pinus in hortis,
> Populus in fluviis, abies in montibus altis:

and to add,

> Sæpius at si me, Lycida formose, revisas,
> Fraxinus in sylvis cedat tibi, pinus in hortis.

But, if my Lycidas will ease my pains,
And often visit our forsaken plains,
To him the tow'ring ash shall yield in woods,
In gardens pines, and poplars by the floods.

This stanza, notwithstanding its pleasant turn, is but a feeble amplification of the preceding; Thyrsis expressing only the agreeable relation between some trees and their situations, followed by a similar description relatively to his friends. But Corydon strikes a more animated note, and, after recapitulating the relations which certain trees have to heroes, gods, and goddesses, quits the whole to pay homage to a humble shrub, because it was admired by the object of his affection:

Populus Alcidæ gratissima, vitis Iaccho:
Formosæ myrtus Veneri, sua laurea Phœbo.
Phyllis amat corylos: illas dum Phyllis amabit,
Nec myrtus vincet corylos, nec laurea Phœbi.

The poplar is by great Alcides worn;
The brows of Phœbus his own bays adorn;
The branching vine the jolly Bacchus loves;
The Cyprian queen delights in myrtle groves;
With hazel Phyllis crowns her flowing hair;
And, while she loves that common wreath to wear,
Nor bays, nor myrtle boughs, with hazel shall compare.

Thyrsis employs a harsh colouring in his landscape, and does little more than imitate the coup-

lets of Corydon; Corydon uses a gentler tone, and bestows praise on his friend Codrus, on whom Thyrsis vents abuse. Corydon delineates the early days of spring, and autumn loaded with fruit; while Thyrsis dwells on the burning heats of summer and the frost of winter. Melibœus accordingly has no hesitation in awarding the prize to Corydon:

> Hæc memini, et victum frustra contendere Thyrsim.
> Ex illo Corydon, Corydon est tempore nobis.
>
> These rhymes I did to memory commend,
> When vanquish'd Thyrsis did in vain contend;
> Since when 'tis Corydon among the swains:
> Young Corydon without a rival reigns.

But it is particularly in the tenth and last Eclogue, entitled Gallus, that Virgil has combined a variety of rural beauties with the tender feelings of love. This may justly be called a chosen piece of poetry; for we have here in perspective the fountain of Arethusa, the sea of Sicily, the solitudes of mount Mænalus, the rocks of the cold Lycæus, and the burning plains of Ethiopia. The poet introduces here flocks, wild beasts, shepherds, Naiads, Apollo, Sylvanus, Pan, and makes these different characters the foundation of the painting in which he delineates the ill-requited love of his friend Gallus.

Cytheris, a famous actress, had abandoned him to follow Antonius to war in Germany, and Gallus addresses to her an expression of the most poignant grief, under the name of Lycoris. He invites her to return to him by the well-known lines:

Hic gelidi fontes, hic mollia prata, Lycori:
Hic nemus; hic ipse tecum consumerer ævo.

Come, see what pleasures in our plains abound;
The woods, the fountains, and the flow'ry ground.
As you are beauteous, were you half so true,
Here could I live, and love, and die with only you.

He pictures her as following his rival in the midst of winter, and the din of arms; and with the attractive situation to which he desires to recall her, he contrasts the rude aspect of Germany:

Tu procul a patria (nec sit mihi credere tantum),
Alpinas, ah dura! nives, et frigora Rheni
Me sine sola vides. Ah! te ne frigora lædant!
Ah! tibi ne teneras glacies secet aspera plantas!

While you, (alas that I should find it so!)
To shun my sight your native soil forego,
And climb the frozen Alps, and tread th' eternal snow.
Ye frosts and snows, her tender body spare!
Those are not limbs for icicles to tear.

Virgil, after combining such a variety of affecting images in his poem, covers the whole with the veil of evening:

Surgamus; solet esse gravis cantantibus umbra,
Juniperi gravis umbra; nocent et frugibus umbræ.
Ite domum saturæ, venit Hesperus, ite capellæ.

Now let us rise: for hoarseness oft invades
The singer's voice, who sings beneath the shades.
From juniper unwholesome dews distil,
That blast the sooty corn, the with'ring herbage kill.
Away, my goats, away! for you have brows'd your fill.

By way of adding to the melancholy of his position, Virgil exhibits himself as weaving a basket of holly-branches, and as seated at the foot of a juniper-tree, a shrub as prickly as the holly, and in this situation he repeats three times the word *umbra,* as if to give a dusky hue to his landscape. He makes it a rule to cast the last rays, or rather the last shades of the setting sun, over his landscape, whenever he introduces a subject of an affecting kind, such as the end of his first Eclogue, where, after delineating the misfortunes of Melibœus, he adds,

Et jam summa procul villarum culmina fumant,
Majoresque cadunt altis de montibus umbræ.

For see, yon sunny hill the shade extends;
And curling smoke from cottages ascends.

A similar remark is applicable in regard to his second Eclogue, where Corydon complains of the indifference of Alexis:

Aspice: aratra jugo referunt suspensa juvenci,
Et sol crescentes decedens duplicat umbras;
Me tamen urit amor: quis enim modus adsit amori?

See, from afar the fields no longer smoke;
The sweating steers, unharness'd from the yoke,
Bring, as in triumph, back the crooked plough;
The shadows lengthen as the sun goes low;
Cool breezes now the raging heats remove:
Ah, cruel heaven! that made no cure for love!

By way of finish to these mournful tints, the despairing swain describes his vine as overcharged with leaves, and as growing neglected beside the elm:

Semi-putata tibi frondosa vitis in ulmo est.

Thy vineyard lies half prun'd, and half undress'd.

The same colouring is introduced at the end of the sixth Eclogue, where Silenus ends his song by an account of the adventures of Scylla, the Sirens, and Tereus:

Ille canit: pulsæ referunt ad sidera valles.
Cogere donec oves stabulis, numerumque referre
Jussit, et invito processit vesper Olympo.

And now the setting sun had warn'd the swain
To call his counted cattle from the plain:
Yet still th' unweary'd sire pursues the tuneful strain.
Till, unperceiv'd, the heavens with stars were hung,
And sudden night surpris'd the yet unfinish'd song.

But when the subject of an Eclogue admits of a fortunate termination, as in the eighth, where a female lover recalls Daphnis by enchantments, the poet introduces it by a description of the morning ray:

Frigida vix cœlo noctis decesserat umbra,
Cum ros in tenerâ pecori gratissimus herbâ est,
Incumbens tereti Damon sic cœpit olivæ:
Nascere, præque diem veniens age, Lucifer, almum.

Scarce from the world the shades of night withdrew,
Scarce were the flocks refresh'd with morning dew,
When Damon, stretch'd beneath an olive shade,
And wildly staring upwards, thus inveigh'd
Against the conscious gods, and curs'd the cruel maid:
"Star of the morning, why dost thou delay?
Come, Lucifer, drive on the lagging day."

Damon, who is the first to entertain a favourable expectation, is exhibited as leaning on an elm crook, the holly and the juniper not being brought forward here as in the tenth Eclogue. Moreover, Virgil, who understood so well the effect of contrasting the singular with the plural number, makes use in these four verses of objects

in the singular only, because he employs the plural repeatedly in the verses which precede and follow them. No poet has more successfully expressed various kinds of harmony and correspondence than Virgil, and his poetry derives innumerable attractions from that source. I dwell on them with pleasure as a kind of incontestable proof of the justice of the observations made in regard to the laws of harmony.

Not content with animating his most interesting landscapes with the light of the sun, Virgil often superadds to it the power of that divinity whom he invokes in the beginning of his work. He considers the sun as the animating power of Nature in a physical sense; but addresses himself to God as the luminary of intelligent beings. In truth, if the sun's light be divided into a variety of rays, and become decomposed into a thousand colours which afford delight to our eyes, the Divinity, though invisible, manifests himself to us by his wondrous works, and may be said to be exhibited in innumerable harmonies which make a delightful appeal to our understanding. The sun, the air, the water, and the earth, have all been adored by various tribes as distinct divinities; although, in the outset, they seem to have been considered only as attributes and emanations of the almighty Being to whom the universe

owed its formation. It is under an impression of a similar kind that Virgil often associates, with his second class of gods and beneficent beings, men distinguished by their power and their virtue, such as those who held the reins of the Roman government in his own days. Thus, in his first Eclogue, his father, under the name of Tityrus, replies to the gloomy Melibœus, who dwelt with admiration on his comfortable situation amidst the troubles that afflicted the country at large:

O Melibœe, Deus nobis hæc otia fecit;
Namque erit ille mihi semper Deus——

These blessings, friend, a deity bestow'd;
For never can I deem him less than God.

The deity here introduced is Augustus, who had given him back his patrimony. In the second Eclogue, Corydon calls to his assistance only nymphs and Naiads, these deities being correspondent to the situation of the invoking swain. He says to Alexis:

Huc ades, O formose puer; tibi lilia plenis
Ecce ferunt nymphæ calathis: tibi candida Naïs
Pallentes violas et summa papavera carpens,
Narcissum et florem jungit bene olentis anethi:
Tum cassia atque aliis intexens suavibus herbis,
Mollia luteola pingit vaccinia caltha.

Come to my longing arms, my lovely care!
And take the presents which the nymphs prepare.
White lilies in full canisters they bring,
With all the glories of the purple spring.
The daughters of the flood have search'd the mead
For violets pale, and cropp'd the poppy's head,
The short narcissus and fair daffodil,
Pansies to please the sight, and cassia sweet to smell;
And set soft hyacinths with iron-blue,
To shade marsh marigolds of shining hue;

Corydon, in his delirium, calls on the nymphs to make presents to Alexis; but the flowers enumerated are as melancholy as himself, and the description of them may be said to form a kind of elegy. They consist of pale violets; funereal poppies; the narcissus, into which the unfortunate youth of that name was changed; of the anise, a kind of fennel with yellow flowers; of the hyacinth, the grains of which are black; and finally of marigolds. All these flowers have an analogy with disappointments in love. No one was more skilful than Virgil in framing a description of corresponding and contrasted objects. Beauties of this kind are of so frequent occurrence in his verses, that it is needless to recapitulate particular examples. They form, in fact, the most powerful attraction of his poetry; an attraction founded on the contrast, not of words

merely, but of things connected by the most agreeable combinations.—*Junctura pollet.*

In the third Eclogue, Damœtas invokes Jupiter, and Menalcas Apollo; both agreeing in placing themselves under the protection of Pollio, the patron of Virgil. In the fourth Eclogue, the poet invokes the Muses of Sicily, who had inspired Theocritus, his model in pastoral poetry; he calls down from the skies several deities to favour the birth of Drusus; Astræa, Lucina, Apollo, and he concludes by coupling with them in some measure his benefactor Pollio. In the fifth Eclogue, two shepherds, Mopsus and Menalcas, celebrate the apotheosis of Daphnis; Mopsus introducing, in the first place, the nymphs who weep over him, and Pales with Apollo, who lament his loss. Menalcas, by way of affording consolation to his friend, has no hesitation in classing Daphnis among the gods, and raises four altars, two for Daphnis and two for Apollo.

——————— En quatuor aras;
Ecce duas tibi, Daphni, duoque altaria Phœbo.

Behold! four hallow'd altars we design;
And two to thee, and two to Phœbus rise;

Virgil, in his sixth Eclogue, introduces Apollo as advising him not to exchange his rustic reed

for the martial trumpet. He avails himself of this excuse to his patron Varus, whose exploits he is desirous of celebrating, and he calls on the Muses to inspire him with sublime songs on the origin of created beings. We have here symptoms of a disposition to take a higher soar; for, under the name of Silenus, he alludes to various poems of which he merely announces the subjects, but of which he exhibits an extensive perspective in his landscape. Moreover, always steadfast in his attachments, he embraces this occasion of ranking Gallus, another of his friends, among the Deities, by introducing him into Parnassus in the choir of Apollo and the Muses.

In his seventh Eclogue, where two Arcadian shepherds are represented as contending for the prize of singing, each makes his invocation agreeably to his particular character. The modest Corydon first calls on the nymphs of the Libethrian spring in Bœotia:

Nymphæ, noster amor, Libethrides, aut mihi carmen,
Quale meo Codrò, concedite (proxima Phœbi
Versibus ille facit); aut, si non possumus omnes,
Hic arguta sacrà pendebit fistula pinu.

Ye Muses, ever fair, and ever young,
Assist my numbers, and inspire my song.
With all my Codrus, O! inspire my breast;
For Codrus, after Phœbus, sings the best.

Or, if my wishes have presum'd too high,
And stretch'd their bounds beyond mortality,
The praise of artful numbers I resign,
And hang my pipe upon the sacred pine.

The proud Thyrsis, devoid of imagination, retorts by imitating his rival's stanza and inverting its meaning. Corydon having paid a compliment to Codrus, Thyrsis passes a sarcasm on him:

Pastores, hederâ crescentem ornate poëtam
Arcades, invidia rumpantur ut ilia Codro.
Aut, si ultra placitum laudarit, baccare frontem
Cingite, ne vati noceat mala lingua futuro.

Arcadian swains, your youthful poet crown
With ivy-wreaths; though surly Codrus frown.
Or, if he blast my muse with envious praise,
Then fence my brows with amulets of bays,
Lest his ill arts or his malicious tongue
Should poison or bewitch my growing song.

Corydon calls subsequently on Diana to be propitious to Mycon. I subjoin the whole of this stanza because I am inclined to think that no translator has hitherto rendered it sense, or comprehended fully the contrast between the generosity of Corydon and the selfishness of Thyrsis:

Setosi caput hoc apri tibi, Delia, parvus
Et ramosa Mycon vivacis cornua cervi.
Si proprium hoc fuerit, levi de marmore tota
Puniceo stabis suras evinc'a cothurno.

These branches of a stag, this tusky boar
(The first essay of arms untried before)
Young Mycon offers, Delia, to thy shrine.
But, speed his hunting with thy power divine;
Thy statue then of Parian stone shall stand;
Thy legs in buskins with a purple band.

To these sentimental lines the unfeeling Thyrsis opposes the following:

Sinum lactis, et hæc te liba, Priape, quotannis.
Expectare sat est: custos es pauperis horti.
Nunc te marmoreum pro tempore fecimus: at tu,
Si fœtura gregem suppleverit, aureus esto.

This bowl of milk, these cakes, (our country fare,)
For thee, Priapus, yearly we prepare,
Because a little garden is thy care.
But, if the falling lambs increase my fold,
Thy marble statue shall be turn'd to gold.

Virgil dedicates his eighth Eclogue to Pollio, and introduces Damon, one of the personages, as making bitter complaints of the infidelity of his dear Nisa, who is about to espouse Mopsus. Alphesibœus entreats the Muses to inspire him, and opposes to the verses of Damon those of a female who succeeds in recalling and fixing her wavering spouse by magic invocations. The poet makes use of contrasts in every way, in regard to the subject, the language, the figures, and the characters. He introduces two other shepherds

in this Eclogue; but since, as in the first pastoral, the only evils complained of are those of fortune, the only deities brought forward are those who take an active part in terrestrial affairs. We have accordingly Varus and the star of Cæsar shining in the vault of heaven; by which we are to understand a comet which appeared some time after the death of Cæsar, and was looked on by the vulgar as his soul. It deserves notice that these deities are invoked by the unfortunate Mœris; the tranquil Lycidas addresses the Muses only.

Virgil has introduced one or two Deities in each of his Eclogues as into so many temples; but in the invocation to the Georgics he may be said to have brought together a Pantheon. After addressing himself in the first instance to Mæcenas, he invokes the Sun and Moon; the gay Bacchus; the benevolent Ceres; the old Fauns and young Dryads; Neptune, Pan, Minerva; Aristæus, the patron of forests; Triptolemus, the inventor of the plough; and Sylvanus, with his bough of cypress. Finally, after having contrasted the whole in a manner two by two, he makes an invocation to Cæsar, to whose choice he leaves the domains of the other gods, such as the Seasons, the Harvests, and the Orchards; the Ocean, as the son-in-law of Thetis; or a constellation between the signs of Virgo and

Scorpio, which are represented as eager to make room for him.

Finally, Virgil, in the Æneid, confers a divine character on all the powers of Nature, after the example of Homer; the sun is Apollo; the air, Juno; the water, Neptune; the earth, Cybele; terrestrial fire, Vulcan; rivers and springs are Nymphs and Naiads; the trees of the forest, Dryads or Hamadryads. The animal kingdom at large is under the dominion of Pan; but the patronage of mankind is shared among several divinities. The birth of children is superintended by Lucina; love, by Venus; anger, by Mars; wisdom, by Minerva; the vintage, by Bacchus; the harvest, by Ceres; the chase, by Diana; and finally, the death of man, by the Fates and Pluto. Most of these deities take a part in the combats of heroes in the Æneid, with the exception of Jupiter, or rather of Fate, who is considered as having previously arranged the destiny of events.

It would be doing great injustice to the passages just quoted from Virgil, to pass an opinion on them from any prose translation. Poetry has peculiar charms which it would be in vain to attempt to render in prose, as a proof of which we have only to make the trial with the finest verses of Racine and La Fontaine. Their charms would soon be found to vanish; and if this be the case

in French, much more does it hold in regard to a version of concise Latin lines, into the comparatively diffuse phraseology of French or English. The observations I have made on Virgil are applicable to most poets of antiquity, and particularly to Theocritus, his model in pastoral composition. We find throughout these writers a frequent contrast, not merely of personal character, but of animals and vegetable products. The subjects of Theocritus have even something more novel and varied, because that poet, living in the Island of Sicily, described the sea as well as the land; shells along with flowers; and fishermen along with shepherds. His landscapes are never more interesting than when sea scenes are introduced in abundance. While Virgil owed a great deal to imitation, Theocritus, it appears, was indebted only to Nature, and the combinations of his own mind. In point of execution, however, the superiority rests with the Roman; the pencil of Virgil being softer, and his subjects more beautifully exhibited. His descriptions, more varied and extensive, have the effect of inspiring, by the magic of their colouring, that tender melancholy which plunges the reader into the most affecting meditation. No wonder then that the Romans should call, after the exhibition of their tragic spectacles, for the repetition of an

Eclogue of Virgil. It was a pillow of down on which they wished to rest their heads before sinking into sleep.—Notwithstanding the superior finish of the Latin poet, so much respect is due to the merit of invention, that I should have been induced to compare different passages of the two poets for the sake of exhibiting the difference of their manner; but unluckily I am not master of Greek, and to quote a good poet in a translation, would be no better than to exhibit the wrong side of an elegant fabric of cloth.

There is no difficulty in finding striking descriptive passages in the works of the distinguished Latin poets, such as Lucretius, Ovid, Horace, Catullus, Propertius, Tibullus, Lucan, and Juvenal; but none of them will be found to come up to Virgil in this respect. Lucretius displays a mind at least equally powerful; but he had studied nature only in the Epicurean system, and we find in his verses none of those contrasts of plants which are productive of such agreeable harmonies, nor of those allusions to the benevolence of the Deity, which elevate our minds from earth to heaven. His sublime and beautiful invocation of Venus forms indeed an exception; but in other passages this poet seems to have eyes for nothing but for the fall of atoms, and his deluded mind exhibits nothing but the gloomy picture of

Atheism in the dreary void into which he sinks. The ingenious Ovid, on the other hand, has scattered deities throughout his Metamorphoses, and may even be said to have mixed them very unceremoniously with animals. His Metamorphoses may indeed be called Metempsychoses, the body of a magpie being made to contain the soul of a princess. Nothing can be prettier than his local descriptions, but, like Quinault, he is apt to throw too great a mass of light upon them. Horace has more precision in his sketches, and more vigour in his touch: a retainer at court, he describes, rather with his muse than with his heart, those rural scenes to which he was not in reality attached. His subjects are chosen in the neighbourhood of Rome, and not in lofty mountains or deep forests, of which however he affords a glimpse in the distance. Tibullus, Propertius, Catullus, all discover the softness of the close of the Augustan age; their painting has much grace and even truth; but it is often effeminate. Under the cruel reign of Nero the rural Muses were silent; how could they raise their voice under a prince who, lost to all natural feeling, despised Virgil, and pretended that he was devoid of talent? Lucan, however, ventured to come forward; his description of the forest of Marseilles is still admired, but the objects are

dark like the time in which he lived, and in which he was fated to become the tyrant's victim. The muse of Juvenal appeared towards the close of this gloomy period, and contracted all that severity which such an age was calculated to excite. No poet equalled him in lashing the vices of Rome; in the midst of so much depravity, how could we expect him to paint landscapes?

I dwell on the propriety of learning to describe Nature from poets, because poetry was the first language of men; it is a singular but undoubted fact that all nations have had great poets sooner than eminent prose writers. Homer, Hesiod, Sophocles, Euripides, flourished among the Greeks before Plato, Xenophon, Demosthenes, Thucydides, Plutarch. Ennius, Lucretius, Terence, appeared among the Romans before Cicero, whose fame in eloquence was in a great measure owing to his admirable use of the Greek poets. Again Virgil, Horace, and Ovid, preceded Tacitus and the Plinys. Among us Corneille and Racine, Quinault and La Fontaine, appeared before our distinguished orators and prose writers, at the head of whom I am disposed to class Bossuet, Fenelon, Voltaire, Buffon, and Jean Jacques. Unfortunately we have had neither epic nor pastoral poets; for by epic poets I mean

those who, like Homer and Virgil, pourtray Nature in all her compass. Voltaire, in his Henriade, has described only battles and political characters. The barbarity of our political situation in former ages having in a manner divided the whole nation into the gentry who followed war, and the poor who followed agriculture, we have had but a small proportion of persons at liberty to study and describe Nature. Nor does our religion, like that of the Greeks and Romans, admit of deifying the different powers of Nature. The sublime conception of one God, the Creator and Governor of the Universe, is much more favourable to morals than to poetry. Accordingly our poets have been obliged to seek for ornaments by imitating those of antiquity, and have been so situated as to be unable to turn the most important of them to account. Our prose writers have consequently been prevented from laying in a store of figures from our poets, and have studied in them only the grace and harmony of style. This, in my opinion, is one of the great reasons of their inferiority to those ancient writers who had such delightful models before them. Philosophy, it is true, has brought us back in these latter ages to Nature; but rather with the view of dissecting and analyzing it than of exhibiting it in landscapes. All our sciences from botany

to astronomy are treated in an analytical, or, as I am inclined to term it, a skeleton method. Those however of our prose writers who have studied Nature in herself, and such as she comes before us in all her harmonies, may be put on a footing with the most attractive writers of antiquity. Their style is full of images, motion, and life. Such, among others, are Fenelon, Buffon, and Rousseau.

With the view therefore of teaching children to express their ideas with grace and precision, I would put before them some examples taken from the best poets and prose writers in our language; adding to these a translation of some of the best extracts from ancient poets on topics most likely to interest a youthful mind. Confining myself in the first place to the delineation of some vegetable harmonies, I would proceed subsequently to the description of a landscape, without however introducing a single living being, not even an insect. So soon as an animal appears amongst vegetable products, it invariably absorbs our attention, on account no doubt of its greater approximation to our own species. I should be sorry to occupy children, as in our old schools, with perpetual translation or barren amplification; but I would make a point of showing them first a regular and simple method of arranging

their subjects by introducing successively elements and vegetables in them; and, after having familiarized them with a certain number of pleasant expressions and terms, I would say, "You are now capable of describing what you see, and your pallet is sufficiently provided with colours: proceed to draw and paint. If your heart possesses sensibility, your pencil will not misgive you; do but feel and describe, and you cannot fail to excite interest."

I would make choice of a pleasant spring morning to put their sensibility to the test. While the young girls, amid the flowers of a meadow, would be occupied in making nosegays, garlands, or chaplets, their youthful companions would be employed in composing a description of them. The most clever of the latter would pourtray a part of the surrounding landscape; and, after delineating the sky, the water, the eminences and trees, as well as ascertaining its position relatively to the sun, they would contrive by some traits to convey an impression of Divine bounty. An ancient artist would have been at liberty to have placed a Naiad at the source of a rivulet, and there is no doubt that the presence of a divinity in the landscapes of ancient poets contributed greatly to their enchanting appearance. Their meadows were rendered doubly at-

tractive by the dances of the nymphs, and the forests acquired additional majesty from the introduction of old Sylvanus; but if reason has stripped the works of Nature of these fancied divinities, she shows us at present the hands of the Supreme Being in every quarter. Enlightened by the discoveries of distinguished philosophers, and the experience of a course of ages, she proves to us that one Being, infinite in duration, in power, in intelligence, and in goodness, is the author of the beautiful combinations of our system. Truth possesses more attractions and wonders for us than the gay visions of fiction did for the ancients. The change of a shaggy caterpillar into a glittering butterfly is at least as wonderful, and certainly more agreeable, than that of Philomela into a nightingale. A simple flower is found on examination to afford convincing evidence of the existence of a Divine Providence. That flower is as much in harmony with all the elements as a complete landscape; it is connected with the sun by the reflectors of its petals; with the air by its calyx; with rain by its leaves; and with the ground by its roots. But it is in tracing the connexion between vegetable products and the wants of intelligent beings, that we become most completely aware of the extent of their harmonies. A linnet's nest is protected by a thorny

bush, and a turtle-dove's by the height of the tree on the summit of which it is placed. Our children, being more helpless than the young of any animal, are in consequence provided with the greatest protection; Nature having given us faithful dogs and ample means of putting our habitations in a state of safety against the incursions of wild beasts.

It is customary to teach children to speak, but not to arrange their ideas in any kind of order. Rudiments and treatises on grammar and logic are unsuitable to them, because they present only abstract ideas. To form their style they should first have access to a pleasant model in an eminent writer; the structure of the composition will be subsequently explained to them, and it then will be no difficult task to accustom them to give a plain and interesting account of what they have seen and thought. No fear of instruction thus conveyed being unpleasant, for the youthful student will be amply repaid if he does no more than preserve affection for the first objects of his application. Too often does it happen that such objects inspire an unpleasant feeling in consequence of the tears they make us shed in infancy; but were they made to present to us an animated picture of comfort or happiness, we should return to them with pleasure in our

ripened years. How many persons have found a permanent gratification in the works of Homer, Virgil, and Horace, because these poets had been the delight of their youth. Our mind naturally clings to a favourite author; he is a pillar that supports us against the storms of life.

Rousseau was in the habit of carrying Tasso almost always in his pocket. It happened one day that, after a squabble which had prevented us from visiting each other during several weeks, we met *tête-à-tête* in a coffee-house in the Champs Elysées. This *rencontre* took place in a small summer-house in the garden of the Hotel d'Elbeuf, which had formerly served for bathing-rooms to the Marchioness of Pompadour. We were alone, and, after we had bowed to each other without speaking, Rousseau was the first to enter into conversation. "People," he says, "are in the habit of boasting greatly of the perfection of our arts at the present time; but I have here a small book, bound thirty years ago in parchment, and as fresh as if it were new." "What book is it?" said I. "It is," he replied, "Tasso, of whom I am very fond." "You treat him then," I rejoined, "as you treat your friend; you make little use of him;" he smiled and said, "I carry him very often in my pocket." He proceeded to pass high encomiums on the poetry, and to quote

different stanzas: among others the description of an army perishing of thirst, and a part of the affecting episode of Olinda and Sophroniba. I brought forward Virgil by way of parallel, and quoted several passages from the distressing picture of the love of Dido. He admitted that the passages were very fine, but added that he preferred Armida to Dido, because he recognized in her more of the features of the female character. After this friendly conversation, we took a walk together in the best temper imaginable. This amiable man was not in the habit of fostering resentment; he never spoke ill to me of his greatest enemies. His faults lay solely in his head, which was often disordered by the remembrance of past misfortune, and by a dread of the future. Tasso was not the only book in which he had looked for consolation: he had found a great deal from his earliest years in the biographical labours of Plutarch, which was the only book of his library that he kept when necessity obliged him to bring the rest to sale. In his latter years he had made a small book out of some sheets of the Old and New Testaments; among others out of the book of Ecclesiastes and our Saviour's sermon on the mount. This also he was in the habit of carrying about with him, until he told

me one day with grief that it was stolen from him.

An affectionate heart, on the look out for an object of attachment not likely to undergo change, is apt to believe that it may be found in a book; but, in my opinion, it is better to fix our attachment on Nature, which like ourselves is in a course of perpetual change. The most sublime book recalls to us only a dead author, while the humblest plant speaks to us of an Author whose days know no end. Besides, is the best of human works fit to be compared with those which proceed from the hand of God? Time and improved education may call forth many a Theocritus and Virgil; but it belongs to Nature alone to create new landscapes. The labours of art carry us back to the past; Nature moves forward along with us, and brings us in contact with the future. Let us therefore follow her through the succession of seasons, and seek our enjoyment in the waters, the meadows, and the woods, varied as they are by incessant change. Let us not be dependant for gratification, in our latter years, on the recollections of youth; but let us advance with joy, under the Divine protection, to those days which are destined to be eternal.

The study of Nature is so extensive that every child may find in it the means of displaying his particular talent, or of gratifying his particular predilection. It is said that D'Anville, when at school and college, studied in Virgil nothing but the travelling route of Æneas, of which he composed a very good itinerary. All the beauties of poetry were lost on him; he saw in Virgil nothing but a geographer, and thus gave an earnest that he would one day become a geographer himself. But Nature offers to man a poem of much greater extent than the Æneid: let each child study it agreeably to its instinct, and some good or other will always result from it. A meadow is capable of suggesting a variety of ideas: a botanist will find in it a system; a physician, healing herbs; a painter, garlands; a poet, harmony; a warrior, a field of battle; a lover, a scene of repose; a countryman, a crop of hay: but were young people to find nothing in it but nosegays, leave them at liberty to pluck them, and put them on the heads of their female companions; the simple and innocent games of infancy are better than the anxious and painful studies of man.

We have hitherto spoken only of the harmonies of vegetable products in regard to the ocular observation of children; but those which they present to their other senses, particularly to their

sense of taste, are calculated to excite a still stronger interest. Fruit-trees, as we have already observed, are generally less lofty, and more easy to climb than forest-trees: particularly those which bear fruits that are tender, and would be liable to injury on falling, such as apples, figs, apricots, &c. On the other hand, trees bearing hard fruits are of great height; this is the case with chesnut and walnut-trees; the fruits of which are enclosed in a tender covering, in the same way as walnuts; or in a shell covered with points which are not prickly but have an elastic spring, as in the chesnut, that they may receive no injury from falling on a rock, or other hard foundation. The ripeness of tender fruits is signified by the emission of an agreeable smell, which is one more harmony placed by Providence between our senses and our wants. Ripe fruits may be said to harmonize farther with our eyes, by the liveliness of their colour; with our hands, by the roundness of their shape; with our teeth, by their tenderness; and, what is most important of all, with our sense of taste, and with the various humours of our constitution, by that delicious and varied savour which points them out as fit for consumption. Strawberries, cherries, and other fruits of a similar description, become ripe in the early part of summer; while

saccharine fruits, like prunes, apricots, and peaches, are formed towards the close of that season. Each seems adapted to the state of our bodily temperament at the time, our blood beginning to partake of the heat of the season at the former epoch; and at the latter requiring a gently cooling acid. Fruits approaching to the quality of the vine, and fitted for cordials, such as apples, pears, and grapes, become ripe as is well known in autumn, and are useful in strengthening our body relaxed by the too great perspiration of summer; while fruits of a healing and oily nature, such as nuts, walnuts, almonds, give heat to our stomach, and aid our means of digestion. Finally, corn and leguminous plants give us at all times farinaceous substances, which renew the different humours of our constitution by the process of digestion. Gramina, and certain kinds of roots, possess in some degree the same properties.

There has been lately discovered in Prussia the art of extracting a kind of sugar from turnips. Sorrel affords us an acid which is one of the best antidotes against an overflow of bile; cabbage is a very good anti-scorbutic; succory is a pectoral; parsley warms us, and lettuce is refreshing and laxative. The ancients appear to put confidence in mallows as a pectoral; *malvæ*

salubres corpori is an expression of Horace. Children may thus find not only nourishment, but salutary herbs, in our garden-plants, and in the fruits of our orchards. Their predilection for fruits is a natural instinct; and so much is this the case that the relish declines as they advance in years, and as their blood has less need of such refreshments. We must be careful however that they use none but ripe fruit; for inasmuch as the latter are healthy, in the same degree is unripe or decayed fruit of a contrary tendency. Cherries, every body knows, are useful in curing several complaints incident to the season of spring; and the philanthropic Tissot assures us that fresh grapes are a cure for dysentery. In proof of this he cites the case of a Swiss regiment cured of that malady by being quartered in a vine country; yet we have seen in the present day a Prussian army contract this distressing complaint in the vine country around Verdun, where it found it necessary to make a halt for some time. The difference was that in the one case the grapes were ripe, and in the other green. Most of the fruit sold in our markets is of the latter description, the ignorance and avidity of the country people making them pluck them too soon; they are consequently pernicious, and diseases are very common in years

of abundant fruit; while a stock of health might be derived from that quarter, were people to have sufficient patience and discrimination. The goodness of vegetable nourishment is to be judged of, in a great measure, by the taste: some persons lay it down as a rule that whatever is eaten with pleasure will be digested without difficulty. The same is said likewise to hold in regard to remedies for illness; medicines of disagreeable taste causing us nothing but indigestion or, as we think fit to term them, purgations. I confess myself a convert to this opinion, and I maintain, against all the systems of our physicians and moralists, that there exist no medicines useful for body or mind, except those of an agreeable quality.

However, if we who are grown-up, and accustomed to old habits, find a difficulty in relinquishing animal food, or in withdrawing our confidence from the disgusting potions prescribed by medical men, let us at least encourage in our children milder and more innocent habits. They have naturally a taste for vegetable diet, and the apprehension is lest they should go to excess in it. They have a strong predilection for fruit, and we must be careful to prevent their plucking it before it is ripe. It is only at that time, or when it becomes decayed, that fruit can be hurt-

ful to them. I have seen children recover speedily from the consequences of the measles under a discreet use of cherries; and my little daughter, at the age of three years and a half, was cured of an obstinate hooping-cough by a prudent use of gooseberries.

It would be superfluous to bring forward cautions against accustoming children to intoxicating liquors; it is dangerous even to make them drink wine, however different may be the opinion of persons in the habit of cultivating vines. Children, as well as savages, discover an evident repugnance at first for this fermented liquor. Judge of its operation on a constitution like theirs, replete with an extra share of warmth, by the effects which it produces on persons grown-up. Observe the latter as they take their seats in a tavern; at first tranquil, afterwards cheerful and overflowing with cordiality to each other; but pass the door of the house two hours after, and you will find the air re-echo with oaths, quarrels, and blasphemy. Their next step is to personal violence, throwing candlesticks and kitchen-irons at each other's heads. You will now see their wives running dishevelled to separate them; but there is generally one unlucky member of the party wounded in the fray. So short is the passage from cordial attachment to acts of vio-

lence; such is the degree of heat and fury engendered by partaking of the contents of a cask! That heat and fury, it may be said, were previously in existence in the breasts of these unlucky men; but, supposing that the case, it was wine which called them forth, and which led to the explosion of the mine. Wine is wholly unsuitable to the warm constitution of children, and there can be no greater error than to suppose that it has a tendency to expand and fortify their bodily powers. Compare the shape of the Turks and other nations habituated to drink water, as well as the freshness of their females, with the diminutive stature and pimpled faces of both sexes in a wine country, and you will be surprised at the difference. The frequent use of spirituous liquors is incalculably more dangerous; for it brutalizes all our senses. This, much more than war, is the destroying cause which wastes the savage tribes of North America. It is injurious likewise to population among the lower classes of the people in several nations of Europe, and should be discountenanced by government as much as possible. Wine should be given to children only as a medicine; and in the case of men, when taken with moderation, it may form a healthful and pleasant cordial. With this reserve I am disposed to allow that it may increase the strength

both of mind and body, and be useful to those whose blood is chilled by years or by melancholy. Children, it is clear, are not in a situation to require a cordial of this description. If wine is the milk of old age, milk may justly be called the wine of youth.

I approve still less of the practice of giving children tea, coffee, or chocolate. I will not now examine whether tea relaxes or clears the stomach; whether coffee alkalizes the blood or dispels the vapours of the brain; and whether chocolate thickens our humours, or is the means of giving us strength. My notion is that such drinks do good to children from the time they begin to take them with pleasure; but I consider them for the present, not in a physical, but in a moral and political point of view. It is as improper to give children a luxurious taste in diet as in clothes and furniture, and they ought not to be taught to prefer the products of foreign countries to those of their own. We can easily see that the fundamental bases of morality are to be sought in Nature, and those of national policy to be laid in the moral education of our youth. Nothing, in my opinion, can be less judicious than to place ourselves in a dependence for the supply of our primary wants on nations situated at a great distance from us; or to be brought

into a situation in which the deprivation of tea, coffee, or sugar, would appear to us in the light of a serious calamity. I was an eye-witness of the first disorders in Paris, during our terrible revolution, and they began by the washer-women, who, impatient at the enhancement of sugar and coffee consequent on the disorders in St. Domingo, burst into the grocers' shops and laid violent hands on those articles. I saw afterwards the same women wait patiently at a baker's door until they received the slender pittance of four ounces of bread, after standing several hours. We should be at no loss to find in our own country satisfactory substitutes for these foreign commodities; honey contains a larger proportion of saccharine matter than sugar, and our aromatic plants can afford us a seasoning as agreeable, and more healthful, than the spiceries of the Moluccas. How many combinations and discoveries of this kind may we not make in prosecution of our botanical researches. The tea-leaf was the sport of the winds during ages in China, and coffee-grains were trodden under foot by the cattle of Arabia, without its ever being suspected that those bitters, prepared by means of water, sugar, and fire, would one day be considered as delicacies in Europe. Was not our olive a long time a prey to birds in the islands of the Archipelago,

before it occurred to the ancients to extract its oil, and to draw off its bitter by means of a ley? Nature had already given the olive to animals; but the intelligent mind which taught the Athenians the manner of preparing its fruit for use was the Minerva who actually conferred that present on men. What a quantity of leaves, grains, and berries, the preparation of which might, in some way or other, be rendered agreeable to us, are lost in our meadows and forests! Where shall we find a vegetable that requires more trouble, and a more circuitous preparation, than corn before it is brought into the shape of bread? Were we to place an American savage accustomed to live on yams and the produce of the chase, whose only clothing, moreover, is the skin of a wild beast, in the middle of our rich fields covered with such a variety of vegetable products, is it likely that he would conclude that the small grains of the corn-stalk formed the foundation of the diet of a people possessed of so many other resources? Would he not be more inclined to imagine that those ears were the food of birds? Would it ever occur to him that flax and hemp produced the fibres of which we make our linen, and that beautiful white paper is fabricated out of rags? Could he have any conception of the plough, the mill, the process of grinding or

baking; in short, of a variety of manufactures of all kinds, the materials of which are supplied by our vegetable products? So ignorant would he find himself in regard to all around him, that he might experience the pangs of hunger amidst our corn-fields, the attacks of cold in our dwellings, or of *ennui* in our libraries. Let not the European, however, make a vaunt of his superior knowledge; for it has so often been turned to an improper account, as to exhibit us in little better than the light of savages in the bosom of Nature.

Reverting to the treatment of children, it seems to me that the time when they begin to eat alone is the most suitable period for giving them an idea of our domestic plants, and of the arts by which they are adapted to the supply of our wants. A man, whatever be his condition, ought to be acquainted with the method of cultivating corn and leguminous plants, as well as with the process by which they are converted into food. He ought to be able to prepare his victuals in case of need, in the same way as it is proper for us all to know how to put on our clothes. It would be well, likewise, that we knew how to prepare our principal drinks; since it is impossible to say in what situation time and chance may place us. I have seen in Russia, and even in our armies, officers to whom a knowledge of

this kind proved extremely opportune. How fortunate was it for Captain Cook to be familiar with the method of making beer from the branches of the spruce-fir, an expedient which preserved his crew from the scurvy during their tedious circumnavigation.

But it is particularly incumbent on young females, who are one day to take charge of the management of a house, to be familiar with the method of preparing and preserving provisions, as well as of useful and agreeable liquors. How great pleasure must it afford them to be useful at an early age to their parents, and to possess a knowledge which must be so important in the eventual situation of a wife and a mother! How gratifying must it be to surprise their family with the sight of fruits and leguminous products preserved in all their freshness throughout the rigour of winter! To possess in spring the fruits of the preceding summer, preserved by means of skill and attention, is, in a manner, to carry the enjoyment of our gardens throughout the whole year. To these useful attainments they ought to add a knowledge of the manner of preparing flax and hemp; of spinning, weaving, and washing linen. Elementary books on chemistry will present them, not with profound reasoning, but with simple results, in regard to the processes of

baking, fermenting, washing; and, in some respects, of dyeing. There is a close connexion between attention to these economic arts, and the preservation of innocence in the conjugal and maternal relations. At present we have the discouraging practice of putting into the hands of children of both sexes a number of moral and philosophical books, which can hardly fail to fatigue a youthful mind. Would it not be much more to the purpose, to offer them a plain account of those things which it is the province of a father and mother to know, with a view to the maintenance of plenty and propriety in a family? Will they not find a more complete proof of the existence of God, of the gratitude which we owe to him, and of our duties to our fellow mortals, in the blessings afforded by Nature, than in books? A friend of mine happened one day to visit a Carthusian. It was in the month of May, and the garden of this solitary man was covered with flowers along the borders and walls; while he sat retired in his room, a stranger to the beautiful spectacle. "How happens it," said my friend to him, "that you have closed your shutters?" "I do it," replied the Carthusian, "that I may meditate without interruption on the attributes of the Divinity." "And you expect," rejoined my friend, "to discover more striking attributes of

the Divinity in your reflections, than in contemplating the works of Nature at this delightful season? If you will take my advice, you will open your shutters and close your imagination."

I have noticed this anecdote, I believe, in another place; but it is worth repeating, as illustrative of the manner in which the human mind misleads itself. How many books on Nature and the Author of Nature have been compiled in dark rooms!

Men are desirous to know the attributes of the Invisible Being, and they are strangers to those of the sun, which exercise an operation on all our senses. Every plant will be found to express some harmony of the orb of day; while the whole vegetable kingdom is nothing but a page of the immense book of his properties. Who would then presume to calculate the power of the Author of Nature, who has established the harmony of the sun with different worlds; and, as far as we can judge, with so many other suns? But, to confine ourselves to that which we inhabit, I am induced to think that geography may be successfully taught to children by means of plants. It is difficult to impress them at first with abstract ideas of an equator and a meridian, of latitude and longitude. We, who are grown up, are in the habit of fixing a number of particular facts in

our memory, by connecting them by general rules; but children, being incapable of comprehending such a connexion, are disposed, whenever a general rule is mentioned, to reduce it to a particular example; first with the view of comprehending it clearly, and next for the purpose of recollecting it. They require a point on which their judgment can lay hold, and on which their memory may impress a mark. Many grown-up persons are like children in this respect; hence the superior power of example to precept.

I would accordingly set out with apprizing children that they ought to distrust the testimony of their individual impressions, and I would introduce some remarks on the heavens and the earth, by way of illustration. "The heavens," I would say to them, "seem to you to form a vault, and the earth a flat surface; now the case is quite otherwise. The heavens have no determinate form, being a space, as far as we know, without limits, while the earth, on the other hand, is round; and, could you continue to proceed month after month in the same direction, you would perform its circuit. The earth is an immense ball of 2864 leagues in diameter, and of 8582 leagues in circumference. It is suspended in its place by the power of the Divinity, who keeps it in equilibrium by the positive and

negative laws of attraction. You believe," I would add to my young pupils, "that the earth is larger than the sun, which, in fact, appears to be not much bigger than your hat; but the case is quite otherwise, the sun being many thousand times larger than the earth, and appearing small in our eyes from being at the distance of thirty millions of leagues. You are disposed to think, likewise, that he rises in the morning and retires to rest at night: here again is a deception of our senses, for it is the earth that turns round the sun, while the latter remains immoveable. The divine wisdom always employs the most direct method, and will be found to do nothing in vain. Were the sun to turn round the earth, he would describe daily a circle of more than ninety millions of leagues. This curious knowledge has been derived from the combined observations of a number of men dispersed in different quarters: so that you see how much reason you have to feel grateful to them, since of yourselves you could know but little." God has made knowledge and comfort the reward of our union and co-operation.

It is easy to give children an idea of the rotatory motion of the earth, and of the effects of the sun on our globe, by that of a ball turned round before a torch. I would thus give them a

general notion of the magnitude of the earth, of its distance from the sun, and of its daily and annual movement. I would next point out to them the four cardinal points of the horizon to which their view would be directed at mid-day; to this I would add the two poles and the principal circles of the sphere.

After communicating these preliminaries, I would endeavour to give children an idea of the principal parts of the earth by means of different vegetable products, beginning with those cultivated in our own country. I have heard of a person proposing to teach children geography, by characterizing each town by some delicacy of the table. Thus for example; Rheims would be distinguished for its gingerbread; Verdun for its sugar-plums; Rouen for its apple-jelly. An epicure's dictionary on this plan might have been as acceptable to grown-up men as to children; but I cannot approve of laying the foundation of knowledge in what must be termed a vice. At the same time we may perform a very useful service in giving some extension to the first notions of geography, by comprising in our description the interesting plants or useful animals of the spot in question; but particularly the men who have been useful to their species. Something of this kind was attempted in the republican calen-

dar; but plants, tools, and animals are not calculated to excite lively recollections. Moreover, there was not introduced into that calendar the name of a single distinguished character, as if talents and virtues were not as worthy of the admiration of the public as geese or garlic.

I am inclined to think, therefore, that geographical lessons, pointing out whatever is most interesting in the different parts of the world, would have the effect of stamping leading facts on the memory in a useful and durable manner. Such a mode of instruction might contribute to lessen the pernicious prejudices existing between nation and nation, and even between province and province. It might conduce to increase our attachment towards our fellow-creatures, by a conviction of the advantages of other situations; and by gratitude for the benefits which the inhabitants of them had conferred on mankind.

Without dwelling on these moral relations which extend so widely and last so long, we shall find that Nature has established throughout the world such a variety of physical relations, that there will be found hardly any man, whether savage or civilized, who does not habitually use some production or other of a foreign country. The Laplanders, the American savages, the African negroes, make use of our guns, our harpoons,

our needles, our linen cloths, and our spirituous liquors. Again, the poorest man in France is in the habit of taking snuff, which comes from America; while his wife's blue handkerchief is manufactured of cotton, and dyed with indigo, both the produce of a distant region. As to our men of fortune, they may be said to draw the supplies of their luxuries from every quarter of the world.

Proceeding then on this plan, I would endeavour to give children an interesting account of their country and of Europe, through the medium of the vegetables of which they are fondest; the lesson would be given at breakfast and at their collations. I would say to them, "These apples are from Normandy; these chesnuts from the Lyonnese; these walnuts from Picardy. The trees producing these fruits in France were originally imported from different islands in the Mediterranean: the walnut, as it is said, from mount Ida in Crete; the chesnut from Corsica. It was likewise from the islands in that sea, and particularly from the Grecian islands, that the vine, the olive, the almond, the pear-tree, were transplanted into our climate; the bread you are now eating is made of wheat, which in former ages was introduced from Sicily into France. The ancients relate that the use of corn was un-

known to men, until it was discovered by a female under divine inspiration. They adored her under the name of Ceres, and put her on a level with the divinities of fire, air, water, and earth. Observe and admire the arrangements of Providence in placing the fundamental support of us, ambitious mortals, on frail stalks perpetually shaken by the wind. This sugar, of which you are so fond, is made of the juice of a cane in the West India Islands, at the distance of nearly four thousand miles from France, and is cultivated by Africa negroes, in the degraded situation of slaves: Honey is almost equally agreeable, and is, without doubt, more salubrious. It does not expose mankind to a thousand dangers in efforts to fetch it from beyond seas; and it has never cost tears to those industrious insects which gather it, humming in the bosom of flowers. Mankind, on the other hand, extract sugar from the ground by the compulsory labour of their fellow-creatures; and they convert into a source of affliction that which Providence intended for a blessing."

It is thus practicable to give to children, by means of a mere sugar-plum, both ideas of geography, and sentiments of justice, piety, and gratitude. The humblest plant may be made instrumental in suggesting the most affecting recollections; and a little garden may become as

instructive as a polytechnic school. On showing them the periwinkle, I would say, "This was the favourite flower of your first benefactor; and I would speak to them of Rousseau, the object of persecution during his life, and of obloquy after his death."

Such illustrations as these would render a small town of more importance in the eyes of children from its producing eminent men, than those which have acquired celebrity by riches or by conquests. They would thus be led to sound conclusions, and would acquire the habit of appreciating things by the extent of their utility to mankind. Their first impressions of humanity and religion should be grounded on the gratification of their wants and their pleasures. They would thus learn to feel how greatly they are indebted, both to their fellow-creatures, and to that Being who has conferred on them a life susceptible of such great enjoyments, with the intention of enabling them to command the products of the earth at large; and of linking men together by that combination of exertions which is required in the mutual supply of each other's wants. A study of plants would accordingly produce in them piety towards God, and affection towards men, the two grand objects of morality.

Rousseau was in the habit of saying that

nothing conduced so much to render us amiable as the study of botany; I stated in opposition the example of two distinguished botanists, who had been at the Isle of France, and had made themselves a number of enemies there. His answer was, "When we study botany for its own sake, it will be found to soften the character; but when we study it with a view of teaching it to others, we are in danger of becoming jealous, envious, or intolerant; our interested views spoil every thing. Philosophers are in the habit of declaiming against the intolerance of theologians; but the latter form only one part of the catalogue, and philosophers must be admitted to be as intolerant as their enemies." Rousseau was in the right, for the remarks he made will be found applicable to all sciences where ambition is excited. Nor is the instrument less dangerous on account of its importance; for legislation and religion, which ought to be the great bonds of human union, have often been the cause of the most bitter divisions. Enthusiasts and legislators have repeatedly aimed at erecting empires for themselves; and ambition, as is well known, does not seek to rule over men with a view to their improvement, but to gratify its own base thirst of power.

The ambition inculcated on us from our earliest

years under the name of emulation, is so common in every class of society, that I was by no means surprised to find it among botanists; but I was, I confess, greatly struck, on meeting atheism occasionally in that department of study. I ought, however, to have considered that botanical systems, by exhibiting plants without explaining their uses, have a tendency to lead the mind to such a conclusion. A countryman acknowledges a superintending Providence when he fills his barn with corn, and his cellar with wine; but the pedant, who finds it impracticable to class an infinite variety of plants according to the rules of his unnatural system, is apt to imagine that Nature follows no plan, because she deviates from the one that he has thought proper to lay down. From such impressions we need not be surprised that men proceed to the notion that the universe is not governed by an all-seeing Providence. A countryman, on the other hand, brought up in ignorance, sees nothing in nature but his corn and his vine; he imagines that the sun illuminates only his own horizon, and he knows no God but the God of his own parish. He sees nothing in the world but his own village, and nothing in his village but *himself*; he is intolerant in point of religion, and severe in point of morality. Virgil, who was so familiar with agri-

cultural labours and with those who followed them, uses occasionally the expressions, *durus arator*, *avarus arator*.

If we proceed to consider the harmonies of vegetable products with the elements, animals, and mankind, we shall find them affording evidence of the Divinity throughout the whole surface of the globe. They preserve us equally from atheism and superstition; they hold the same language at every time, and in every place. The stars announce to us a Divinity by the grandeur and regularity of their movements; while the plants do the same by the grace and variety of their harmonies. The heavens display to us his infinite power; the products of the earth, his wisdom and bounty. Vegetable harmonies are as unchangeable as the celestial; and from being more within our line of observation, they offer us a greater proportion of attractive spectacles. Nature may be said to compose new sights for every day, and every year she exhibits them in a new dress, in the different parts of the world, by the agency of winds and waters. She appears to sport with her gifts to mankind, like a kind mother, who throws printed characters among her children, mixed with grapes, almonds, and fruits of all kinds, by way of teaching them to read and to love her. We, alas! engrossed with

the barbarous game of selfish politics, have been in the habit of looking out day after day for the news arising out of these cruel chances; such as victories obtained at a great sacrifice of lives; cities bombarded; squadrons set on fire; negotiations conducted without integrity; and destructive famines. Yet every night and every morning place before our eyes fresh evidences of the wisdom and goodness of divine Providence. The corn which is coming into ear, the vines displaying their flowers, and fruits acquiring a gradual consistency and size, all incessantly invite us to turn our eyes towards Providence, and to act a kindly part to each other.

The study of the harmonies of Nature will not fail to give rise to a system of religion and morality of a more solid character than that which derives its origin from books. After impressing on children arguments for the existence of Providence by the spectacle of a tree loaded with fruit; lessons of justice by obliging them to abstain from the trees in our neighbour's orchard, and of temperance in the use of the fruits which belong to themselves; I would proceed to inculcate generosity and gratitude, by accustoming them from an early age to share their fruits with their young companions. It is from gratitude that the social relation of animals with man take

their origin. Animals are domesticated, not by violence and artifice, but by acts of kindness. Man, obliged by the arrangements of Providence to cultivate the ground, was naturally led to present to animals from the beginning the straw of his sheaves, the chaff of his grain, and the fragments of his table. Those acts of benevolence, slight as they were, had in process of time the effect of bringing under our control the spirited horse, the warlike bull, and the watchful dog. The feebler part of animals gradually placed themselves under the protection of man; the pigeon taking up an abode in his roof, and the fowl in his dunghill. However limited the power of instinct, and however remote from that knowledge which gives the impression of duty, certain it is that animals have a clear perception of the superiority of man. The carnivorous tribe avoid his steps, while the tame call aloud on him for assistance in time of trouble. Now the latter experience his power only by means of his gifts to them out of the vegetable kingdom. How is it possible then that man, stationed in the midst of the gifts of Nature, should be without a sense of duty towards that Power to which he owes every thing? Is it possible that he can be without gratitude in contemplating a fruit-tree proportioned to himself in height, and the fruits of

which are in harmony with his sight, his smell, his taste, and his constitutional wants. Doubtless he feels that so many kindred relations are the work of an all-seing and beneficent Being. If the animals, when in distress, raise their voice to man for assistance, shall not he in return raise his to Heaven in gratitude for being appointed the distributor of so many blessings. Man is a demi-god in the eye of domestic animals; but in the sight of God he is himself but a poor unprotected creature. Let a child be accordingly taught to say a prayer as soon as he is able to eat by himself.—For a long time he is apt to see in the elementary powers only insensible and sometimes pernicious causes; the ground hurting his feet; water threatening him with the danger of drowning; the air and wind proving occasionally inconvenient to him; and the sun either dazzling his eyes, or incommoding him by intense heat. The vegetable kingdom, however, is always of assistance, and enables him to find a shelter against the injurious effects of the elements. A tree is interesting to a child in every season:

—— Liberal, il nous donne
Ou des fleurs au printemps, ou des fruits en automne;
L'ombre, l'eté; l'hiver, les plaisirs du foyer.

La Fontaine, *Fable de l'Homme et du Serpent.*

Let it, therefore, be a rule with every mother to teach her child to say a prayer as soon as it is enabled to gather a fruit; its gratitude towards God will be an assured indication of affection towards its parent. Let a child be taught, likewise, to pray daily when waking and going to sleep; that it may acquire the habit of putting its confidence in its Creator, and of relying on him in all the occurrences of life.

When a boy is learning to swim in a river, the fear of drowning, and the coldness of the water, are apt to prevent him from venturing along with the current. A wave must bear him up before he acquire the use of his arms, or feel that his body is naturally in equilibrium with the water. In this ocean of life, which we are all fated to cross, it is not accidents, but the gifts of Providence, which take us out of our depth. Let us accordingly go along with the current; calling to our aid the resources of our mind, which are in harmony with the Deity, to raise our thoughts and actions towards him. If we are distrustful of Providence, we shall find life a burden; but if we place our confidence in our Creator, there is no fear of our being carried safely through our eventful career.

It is for you, my dear Virginia, the joy of my latter years, that I have penned these last lines.

If you are spared to attain the age of reading and understanding them, do not forget your father's first lessons, and do not fail to repeat them to your little brother. Extract your fairest ornaments from flowers, your healthiest diet from fruits, your pleasantest task from plants. I have no ambition to make you a botanist: do not attempt to pass with a scientific eye through the immense temple of Nature, but remain under its portico, seeking no other evidence than that of your wants and your feelings. Let the simple strawberry be your first object of attention, and fruit-trees the source of your contemplation and devotion. Occupations such as these will make the blood circulate agreeably through your veins, and will bring delightful images to your imagination. Never will you feel yourself solitary even in a desert—go where you will, you will recognize a protecting Providence; every herb will excite a pleasant impression, and every fruit an emotion of gratitude.

It was by such habits and such manners that the first names among the females of antiquity were enabled to perform their domestic duties with applause. Beware of uniting your lot in life with that of any one who has not a similar feeling of the beneficence of Nature. In that class only can you look for a virtuous character;

for a Lysis, an Epaminondas, a Cincinnatus, a Fabricius, a Scipio; and, what in your humble sphere is of more importance, a citizen without fame, but without exposure to envy; a father of a family obscure, but happy; a man little known to the world at large, but agreeable to his Creator. As for me, who am already in the winter of life, if I am not destined to see you approach your summer; if your amiable mother shall have alone the charge of your riper years, after having had that of your childhood; you will discharge a debt both of conjugal and filial affection, if one day your grateful hand shall scatter a few violets on my humble clod.

BOOK II.

AERIAL HARMONIES.

GENTLE Zephyrs, who carry on your wings the first impulse of life and motion; whether you spread in the sky the light sails of the morning, or the dark tempest of the west; whether you ripple the surface of the waters, or scoop them into deep vallies; whether you transport from one extremity of the earth to another those rivers which bring fertility, or detach from the poles mountains of ice to swell the expanse of the deep; whether you sweep lightly the meadows, or rustle through a lofty forest;—it is you who bring animation to what was formerly insensible. How often has your distant noise, and your mysterious echoes, plunged me into delightful reveries! Diffuse throughout my writing the simple harmony of your sounds, and I shall have no occasion to go in quest of deep research or dazzling images to attract my youthful readers. Your gentle murmurs alone will suffice.

Aërial Harmonies of the Sun and Moon.

Our pole is the cradle of the harmonies of the world, and the south pole may be said to be their grave; for it is in its hemisphere that both the African and South American continents come to a close on the margin of a waste of waters. The Southern Ocean offers no fertile regions to the view, and appears to be made up of detached heaps of barren sand, or of a few uninhabited islands little better than shoals. If in the midst of its long winter this ocean receive occasional light, the rays are neither purple nor gilded, like those which at the north pole announce the morn of life; they are pale or livid, like those which follow the setting sun, and bespeak the reign of death; making the waters thus illuminated resemble a funereal lamp resplendent in the midst of tombs.

Yet the sun extends his influence to this region, and conveys heat to it every summer. Our life may be compared to the globe, our infancy being accounted the north pole; our advanced years the south;—all the harmonies of our existence will be found to revolve upon these. The former are brought into display by maternal warmth and

care; but by whom are the latter likely to be renewed? Ah! nothing is impossible to the hand which separates and approximates elements, and which composes all its works of the harmonies of life and death!

Let us for the present confine our reflections to the harmonies of our horizon. The sun has already begun to scatter his tints through the atmosphere; the cold is less intense; the rivulets resume their course; the ground, half covered with snow, begins to disclose some stripes of verdure; the young scions of the trees assume a purple tinge; the aquatic birds, which prefer the region of winter, are drawing towards the north. As yet the sun attains no great elevation at noon, but a south-west breeze frequently blows at this season, and brings us an animating warmth from the bosom of the seas of South America. We may trace in all these the care of a maternal hand. It is the air which brings us this premature warmth; the air, which alone of all the elements surrounds the whole globe; light covering scarcely the half of it at a time, water two-thirds, and the ground only one-third. All the component parts of air communicate directly with each other; for it is the medium of the other elements, and of light itself. Were there no air, the sun's rays would be without warmth; the rivers, and even

the seas, without springs; the ground without rain, and consequently without vegetable products, the support of men and animals.

We may form some idea of the atmosphere by figuring to ourselves a vast glass, convex on the outside, and concave within, surrounding our globe to the distance of several leagues. By means of this disposition the atmosphere collects the rays, and refracts them on the earth. The lower part of the atmosphere is always warm in the torrid zone. It is warm during summer in each of the two temperate zones which border on the torrid, and throughout a great part of the two frozen zones; but the upper part of the atmosphere is always cold even in the torrid zone, as is apparent from the summits of lofty mountains, which, whenever we arrive at any thing like a league of perpendicular height, are found to be covered with snow.

The atmosphere escapes our ocular observation by its transparency, and our grasp by its thinness; nor can it be perceived by our senses of smell or of taste, nor even by that of hearing, unless when in a state of agitation. It is of importance to point out to the observation of children, and even of grown-up persons, that the powers of nature may be in complete existence, although they are imperceptible to our senses.

As sight is the first of our senses, and the forerunner, it may be said, of the others, we are in the habit of appealing to it for our first impressions of the existence of objects, because it is through its means that we form to ourselves an idea of them. It is the sense *par excellence* of our reason, because it at once exhibits to us various harmonies of existing objects, such as colour, shape, and motion; while the other senses are little else than witnesses, *it* may be dignified with the title of judge. Let us beware, however, of concluding that the things we do not see are not in being. This manner of reasoning is common among the lower orders, and not wholly unpractised by philosophers. A man whose talents in my opinion shone brighter than those of any other Frenchman, I mean Voltaire, thought proper in his questions on the Encyclopedia to deny the existence of air because, as he said, it was not perceptible to his view; he supplies its place by the introduction of watery vapours, which admit of being seen, and to which he attributes similar properties.

This system, however, has not the attraction of novelty; it was the system of Thales, who taught that every thing was engendered by water. He admitted the existence of no other element throughout the globe; the ground being, accord-

ing to him, only a sediment, and the atmosphere an evaporation of water. No doubt a quantity of air is contained in water, in the same way as a quantity of water is contained in air; but in addition to the many proofs of a radical difference between the two elements, we have merely to observe that water dissolves most solid bodies, while air not only consolidates them by the process of drying, but has even the effect of giving solidity to fluids. Thus when we open the membranes on the back of the head of the spermaceti-whale (*cachalot*), the oil contained in the cellules immediately thickens and crystallizes; and the same holds in regard to the liquor of a particular zoophite very common on the shelving rocks of the Isle of France. This animal, on being taken out of the water, ejects a white liquid, which becomes forthwith changed into a number of very thin threads. The fluid matter of the silk-worm, the spider, and several kinds of caterpillars, acquire all at once solidity on coming out of the body of these insects, and are changed into a silky substance by mere contact with the air. Such effects as these could not take place were the air nothing but evaporated water: it would have the effect of increasing the fluidity of the substances we have mentioned.

But we carry in our own persons evident proofs

of the radical difference between air and water; I mean in those organs which may without impropriety be called aërial, such as those of hearing, smelling, and breathing. It deserves to be noticed that it is that part of the living creation only which lives in air that has ears to receive vibrations of sound. The organs of hearing are not found among fishes, with the exception of the amphibious tribe; for though fishes are not insensible to noise, the impression on them is different from that which takes place on the other parts of the creation. Moreover, the sense of hearing is, as we shall see presently, a moral sense belonging to the fraternal harmonies; while the sense of smell is common to all animals, and is besides in them the forerunner of taste. The organ of breathing, which has not yet received a name, nor been reckoned among our senses, although the most necessary of all, is intimately connected in animals with the sense of smell. We have received for the purpose of respiration organs known familiarly by the name of lungs, which are in harmony with the air, and by no means with water, which would have the effect of causing a total cessation of their functions. It is on this account that Nature has given to fish gills of a most delicate and admirable construction, that they may be enabled to separate air from

water; an arrangement which she would never have made had these two elements been essentially the same.

It is a point of consequence to accustom people to consider that there are in Nature causes and effects concealed from our sight, and even from all our senses. Attraction, or the tendency of bodies towards their centre, and electricity, the diverging tendency of fire towards the circumference, are in perpetual operation upon us without making themselves perceptible. It is not going too far to say that we are strangers to the essence of any substance; our knowledge being confined to a perception of its harmonies, and coming only through the medium of organs related to those harmonies, and given to us by Nature. Let us therefore be contented to remain within the paths pointed out to us by her, and dread losing our way if we carry our attempts farther; for our senses will not avail us in acquiring a knowledge of primary causes. God himself, the primary cause of all, is far beyond the observation of our organs; but he has been pleased to put in harmony with himself our soul, which is likewise inscrutable by our senses, although it be their enlivening principle.

Let us proceed to examine the principal harmonies existing between air and the sun. Air is

both elastic and compressible, the latter quality constituting an essential distinction between it and water, which cannot be reduced by any human power to a smaller volume than it occupies in its natural state. In regard to the elasticity of air, it is ascertained that heat has the effect of expanding it so as to make it occupy a space four thousand times as great as that which it holds in the atmosphere. It is by the elasticity of air, called into action by means of fire, that the explosion of gunpowder is caused; and if we place near the fire a bottle filled with air and effectually closed, the air on being heated becomes dilated so as to burst the bottle.

Naturalists have, no doubt, invented anti-pneumatic machines capable of producing the greatest compression of air, and have probably availed themselves of the operation of cold for that purpose. Not knowing precisely to what length they may have carried such experiments, I am now to add an observation proving how greatly the agents of Nature are superior to our instruments, and her laws to our systems: it is that the solar fire, to which we very properly ascribe the dilatation of air in the atmosphere, compresses it to such a degree as to reduce it into a state of solidity in vegetable products. Some of these products, like the oak, are said to con-

tain no less than a third of their weight in air, agreeably to experiments made by able chemists, and recorded in the French Encyclopedia. What is still more surprising is, that the air so confined does not bear the mark of compression, since no tube, even of iron, could be made to contain so much as a twentieth of its weight without bursting. The air is consequently blended with the vegetable product by a modification with which we are as yet unacquainted. Perhaps it is reduced in this situation to its primary principles, in the same way as the fire contained in vegetable products, and extracted from them by the process of burning. This idea has been adopted of late by chemists, and appears conformable to the result of experiments.

After these observations on the expansion and compression of air, it is time to say a few words on wind, which is the result of these modifications. Air, when rarified by the heat of the sun in any part of the atmosphere, loses its equilibrium with the surrounding air which comes to replace it, the result of which is a current known in common language by the name of wind. Custom has taught us to class the winds under four leading divisions, which derive their names, as well as their directions, from the course of the sun, their great and primary mover. The names

of these winds are in French somewhat different from the designations of the course of the sun; for while in the case of the latter we say *Orient* and *Midi*, we use *Est* and *Sud* for the winds. In like manner the north and west winds are expressed, not by *Septentrion* and *Occident*, but by *Nord* and *Ouest*. The difference may have originated in a wish to abridge the names of the winds, or the latter may have been derived directly from the Celtic language, spoken, as is well known, by the early navigators of the North of Europe. Some persons however imagine that the word *Est* comes from the Latin *est*, meaning, there *is* the rising of the sun; that *Sud* comes from *sudor* sweat, on account of the heat of the sun at noon; while *Ouest* is traced by those fanciful etymologists to the Latin *ubi est*, meaning, whither does the sun go now that he is setting? For the word *Nord* it would be difficult to find a similar origin, and I have alluded to those imagined coincidences only with the view of fixing the stamp of a useful recollection on the minds of my readers.

Each of the four winds possesses different, and even directly opposite, qualities. The east in this part of the world is dry from passing over a great extent of ground before coming to us; while the

west wind is moist in consequence of traversing a vast expanse of ocean, and wafting us its superincumbent vapours. The south wind is warm, and occasionally hot as proceeding from the torrid zone; while the north wind is cold in consequence of taking its origin from the north-pole covered by a vast extent of ice. Of these four winds are composed all the temperatures of the globe, varied as they are by the sun's course in every hour of the day, and every day of the year.

The above-mentioned qualities of the different winds exist only in our northern hemisphere, and are completely reversed in the southern, where the north wind is warm, the south cold, the east moist, and the west dry. If we take South America as an example, we find the south wind cold, because it proceeds from the south pole, which is covered with a still larger mass of ice than the north pole; and we find the north wind warm because it has previously passed through the torrid zone. The east is humid in that continent, because in passing over the Atlantic ocean it becomes loaded with vapours; and the west is dry, because the lofty chain of the Cordilleras runs parallel with the adjacent ocean, and stops the passage of the clouds to the eastward. The

rivers Oroonoko and Amazons, among the greatest in the universe, are chiefly fed by the vapours wafted from the Atlantic by the west winds.

It is particularly deserving of observation that we find no part of the world where the contending powers of heat and cold, of moist and dry, are not to be met with in the winds which blow there. In countries situated in the central part of continents, we find Mediterranean seas or extensive lakes, which distribute moisture around; in islands placed in the bosom of the seas there are generally chains of mountains which stop the clouds, and afford a dry season to a portion of the adjacent ground. In the frozen zone there are vallies or sandy tracks which send forth rays of heat; and the torrid zone, distant as it is from either pole, contains a number of frozen mountains which refresh its atmosphere. There are moreover in the atmosphere two divisions of air; the lower which is of temperate warmth; the higher which is always cold, and which is made by the storms to descend from time to time into the lower division. From all these arrangements it results that the harmonies of heat and cold, of dry and moist, exist in every part of the globe in different seasons under an infinity of modifications.

Enough has now been said to show that the winds, apparently so inconstant, do not spread their breezes by chance, and that the chains of mountains and basons of the sea, apparently so irregular, are disposed agreeably to a wise plan. These points will be farther illustrated when we come to treat of moral harmonies; when we shall take occasion to discuss various qualities of the air, particularly its capacity of sound. That capacity comes under the department which I have called "fraternal harmony." It is for that harmony that Nature has given a rustling power to the wind; echoes to the mountain; a purling noise to the rivulet; a voice to animals; and to men the power of expressing by speech the affections of the soul in all the modulations of air.

Aërial Harmonies of Water.

AIR is not only susceptible of heat and cold, of expansion and condensation, but it is of a spongy quality; and is adapted to imbibe water. On passing over a wet cloth it dries it more or less by absorbing a portion of the particles of water which caused the moisture. These watery particles, when evaporated into air, are invisible there so long as the air continues expanded by heat; but on its becoming condensed by cold, they resume their former character in mists, clouds, drops of rain, in hail, and in snow. The aërial sponge, compressed by cold, is thus made to return the water it has absorbed. I have often been sensible of this effect, in winter, in the Russian stoves. On opening the door of one of them, the vapours proceeding from the perspirations of the persons within, being suddenly encountered by the cold of the outward air, were changed into a kind of snow on my hat and coat. Something of the same kind is visible in our climate on our glass windows, the vapours contained there being collected in drops of water by the freshness of the outward air. Nature produces the same effects on a grand scale in the upper division of the atmosphere, which,

as we have already remarked, is always cold; the air, by means of its spongy quality, absorbing incessantly the waters of the ocean in the shape of vapour, and returning them in rain and snow to the summits of lofty mountains, where lakes and rivers have almost invariably their source. The atmosphere may be said to resemble the human lungs, and to receive from the action of the sun an impulse similar to that which is given to those organs in us by the heart.

So imperfect hitherto have been our studies in natural history, that we are without suitable terms to express the different properties of the elements. Why should there not be a single word for expressing the spongy quality of air, as there is for its elasticity and condensation? For my part I give notice to my readers that I shall employ without scruple whatever words seem to me suited to convey the ideas which I wish to impress on them. I make use therefore of the terms aspire (*aspirer*) and emit (*expirer*) for want of better, to represent the effects of the spongy nature of air in connexion with water. To use the word attract would not be correct, attraction not being the operation in question; while the word suck (*pomper*) would present likewise an idea different from the one in contemplation.

If the air aspires and emits water, water in its turn aspires and emits air; it is in a manner completely impregnated by it; for you see the air come out in small bubbles from the bottom of a vessel on the fire, or under the air-pump. Air finds its way even to the depths of the sea, being respired by fishes, who find means to separate it from water by the aid of their gills.

I am now going to make an observation calculated to prove the existence of the harmonic laws of Nature, and the necessity of making the study of its different powers go hand in hand. Air aspires water by means of heat, and water aspires air by means of cold; it is by the process of freezing that it becomes filled with air so as to occupy a larger volume, and to float with about a tenth of its size above the surrounding fluid. On the other hand, air emits water in consequence of the action of cold, as is proved in the case of the vapours of a room on the panes of glass in winter; and water emits air by the operation of heat, as we see in the case of a pot or other vessel put over the fire. We thus find that if air both gives and takes away water; water in return performs the same double office in regard to air. From this opposition in their elementary qualities, we may deduce useful conclusions in regard to the harmonies of the globe, and may infer

thar there are two atmospheres in a congealed state contained in the two frozen oceans which cover the poles of the earth; and that the masses of ice descending in summer from the poles, renovate, not only the seas, but the atmosphere of the torrid zone. These icy regions are at once castles of water and immense sponges of air. It follows, as a farther inference, that the ocean is always in a state of evaporation in the atmosphere of the torrid zone; and that the clouds, carried by the winds towards the poles, are sponges of water which renovate the ice and snow.

Air has farther relations with water by means of the attraction of the earth; I mean by its gravity, for the earth attracts it in the same way as it attracts all other bodies. The effects resulting from its gravity are very interesting, both with a view to the study of nature and to the motion of machinery. Homberg, a celebrated chemist, found that the air contained in a small balloon of thirteen inches diameter was an ounce in weight. The experiment was an easy one, the balloon weighing exactly an ounce less after the exhaustion of the air. The consequences of the gravity of air in regard to water may be stated as follows: If you suck with a reed the water of a vase, you will find it rush up the reed immediately; because the atmosphere presses on

the water in the vase, and makes it ascend into the vacuum which you have formed. This is the principle of the common pump, a vacuum being formed by raising the piston, and the water occupying that vacuum; because the weight of the atmosphere presses it from without. Water not rising by this means higher than thirty-two feet an inference has been drawn, with great appearance of probability, that a column of water of that height was of equal weight with a column of air of the same diameter and of the height of the atmosphere. The pressure of the atmosphere is the cause of a number of familiar operations which we never think of attributing to it. It is by means of it that a child sucks its mother's breast; for a vacuum is created in the infant's mouth by drawing in the air in sucking, and the nipple pressed by the atmosphere supplies milk to fill the vacuum. We thus trace the existence, in the earliest days of infancy, of a law of Nature from which the sages of antiquity did not succeed in deducing any useful conclusion. Aristotle was aware of the gravity of air, but he maintained that water rose in a pipe which was devoid of air, only because Nature abhorred a *vacuum*.

We shall confine ourselves, on the present occasion, to the deduction of a few plain in-

ferences from the gravity of air, without enlarging on the well-known experiments of Duperrier. It follows from the law of gravity that the direc- of the wind is oblique from above to below in consequence of its gravity; and from below to above from its elasticity. Were the course of the wind horizontal, as is commonly imagined, the sea would not be furrowed with waves, nor the earth cleared of the vapours which are raised and kept aloft by the wind; its action would be always on a level and parallel to the surface of the water. The tendency to blow obliquely downwards is exemplified in vessels, whose sails are distended in the lower part, while the top-masts are bent in their upper parts. On the other hand, the reflection of the air on the ground has the effect of raising clouds, of marshalling them together in the sky, and of giving them those beautiful curves which we are in the habit of beholding with admiration. Without the operation of some such cause, the clouds would float in the air with plane and sluggish surfaces, as we see in the case of mists. The direction of the wind, therefore, appears a compound of its horizontal movement forward, and of its perpendicular movement downward; so that, combining with this its elastic reflection upwards, it ought to form an inverted parabola.

This, in truth, is the form which I have seen, or imagined that I saw, in the hollow waves when the sea is shaken by a tempest.

I have often stopped with pleasure on the margin of a piece of water, to look at the zephyrs gently ruffling the surface. But nothing of this kind is equal to the varied and interesting spectacle exhibited by the sea; for you may there contemplate all the modulations of the wind, and observe a variety of harmonies produced by the contact of the two elements. In the course of my different voyages, I had a good deal of leisure, and was enabled to make in this respect several observations not unworthy perhaps of the attention of my readers. When, in a calm, the surface of the sea is smooth as a mirror, and similar, in the language of seamen, to oil, I have observed that there regularly was a swell or undulating movement, arising either from an antecedent agitation of the sea, or, as is more probable, from its currents. The latter supposition is supported by the circumstance of the swell continuing the same after several days of calm. When a light breeze begins, you see a rippling of the sea commence at one extremity of the horizon, and run over its whole surface in the course of a few moments. From this I concluded that the velocity of the wind did not de-

pend upon its force; and that it was, in fact, much greater than naturalists generally believed it. As far as I could judge from the impression of these transient winds on the sea, they seemed to pass over a space of ten or twelve miles in a minute. When these winds are stronger, the hollows formed by them on the surface of the sea are nearly contiguous, and assume the appearance of ploughed land; such, in general, is the effect of the trade winds on the seas of the torrid zone. If the wind rises, the waves augment in size, and the upper parts, being thinner of course than the lower, are pushed more quickly forward, so as to roll on themselves and to be precipitated in foam. Seamen are then in the habit of saying that the sea froths, which in French is expressed by *moutonner;* because the whitened spray of the waves resembles at a distance a flock of sheep, (*moutons,*) feeding on an immense azure plain. This is called fresh weather, or a fresh breeze. If the wind rises higher, several of these billows are joined into one, the intervals between them become larger, and the cavities deeper. It is then that they dash against the shore, and form large breakers covered with foam, the hinder part of which has an emerald tinge. This, in the language of seamen, is rough weather, and to ordinary observers would appear a

storm. Often have I taken pleasure, when at Dieppe, in observing the approach of these billows, and in listening to their hollow noise on the pebbles of the beech, when I was seated in a small grotto which reverberated the sound like the drum of the ear. When the sky is covered with clouds hung low in the atmosphere, and redoubled by a moist north-west wind pressing on the sea, the waves, hollow and rumbling, strike the stern of the ships lying to, rise in flakes of foam to the top-sails, and, descending, sweep the decks. This is a tempest in all its rage. A scene of this description fell under my observation when near Cape Finisterre in my passage to the Isle of France; an immense wave passed over the prow of the vessel, and, crossing the deck diagonally, carried off the yawl and three seamen. However, all these effects of the wind and water, calculated as they have been by naturalists who allow only seven or eight feet to the height of the waves, and ten or twelve leagues an hour to the rapidity of the wind, are not to be compared to the hurricanes of the Indian Ocean. The wider the range of these southern seas, the higher rise their waves; the smoother they have previously been, the wilder becomes their convulsion. When we had doubled the Cape of Good Hope, and had entered on the twenty-third of June the

Mozambic Channel, we were assailed by a dreadful gale from the south. The sky was serene, and showed only a few copper-coloured clouds, which seemed to traverse it with great rapidity. But the sea was furrowed by five or six long and lofty billows, similar to chains of hills separated by broad and deep vallies. Each of these aquatic hills was marked by two or three stages; and the winds detached from their angular summits a spray in which the spectator could trace the colours of the rainbow. It swept like a whirlwind the whitened surface, and scattered it at a distance in the vallies; as it raises and scatters the dust in our highways in summer. The most formidable of all, however, was, that the summits of those hills, driven by the violence of the wind to a distance from their basis, formed for a moment an immense vault, which would have swallowed the largest vessel, had it unhappily been placed under them. The condition of our ship was calculated to increase the alarm excited by the storm. Our mainmast had been broken during the night by lightning; our foremast, with our only remaining sail, had been carried off in the morning by a gale; so that the ship had become unmanageable, and rolled backwards and forwards at the mercy of the winds and waves. I stood on the quarter-deck, and kept

fast by one of the benches, endeavouring to familiarize myself with this awful spectacle. On the approach of one of these watery mountains, I perceived its summit at the height of our topmasts; that is, more than fifty feet above my head. But when the lower part of this frightful mass passed over our vessel, the shock was so great that our yards were half immersed in the sea, and the water came up to the foot of our mast, so that our ship was upon the point of upsetting. When, in a few moments after, our ship was on the highest part of the immense billow, it righted and inclined suddenly in the opposite direction; while the water rushed from under it in a sheet of foam with the rapidity of a sluice. We thus remained suspended in a manner between life and death, from sun-rise till three o'clock in the afternoon. It was impossible for friends either to give or to receive consolation, the wind being so violent that we could not comprehend even the words which we strained our lungs to say to each other. The voice was lost in the blast, and we could hear nothing but the whistling of the yards and tackling, along with the hoarse sound of the waves, similar to the howling of wild beasts.

Although I am by no means courageous at sea, I felt confident in the protection of Providence,

and was the first in the morning to put my hand to reef the fore-sail, which the wind was tearing in pieces; not that I thought myself dexterous in such a task, but was desirous of setting an example to the affrighted seamen, who were backward in obeying the captain's order. The poor fellows were alarmed, not only on seeing the prow covered incessantly with billows, but on recollecting the fate of their comrades carried off by a wave from the very spot, in a tempest of much less violence. The feeling which gave me confidence under a danger which none of us expected to survive, was my being at my post and in the exercise of my duty; for I had taken my passage to the Isle of France without any intention of pursuing selfish objects, but from motives of humanity towards the negroes of Madagascar. My original destination had been to Fort Dauphin in that island, but I was not sent thither, and thus escaped the misfortunes of that colony, which lost almost all its settlers in the course of a short time. Thus did a kind Providence prevent my ruin by a course of circumstances which I had long considered in the light of disappointments.

Tempests, such as I have described, called hurricanes in India, and typhoons in China, occur every year about the solstice; although, in

our temperate zones, they take place only at the time of the equinox. It may seem no easy task to prove that they belong to the harmonies of Nature, since their ravages are equally great on land as on sea. However, they are necessary in countries which have no winter, as they clear them of a host of insects, which would multiply beyond all bounds in warm climates. Islands would become inaccessible, and rivers would be blocked up by the enormous shoals of madrepores which sea-insects raise around their banks, if hurricanes did not reduce them by their annual ravages. It is from the wrecks thus caused that are formed the beds of calcareous sand which surround all the islands between the tropics, and contribute no doubt to their vegetation, as well as to their progressive increase.

How happy ought we to account ourselves, we who know storms only by observations performed ashore. Even in this safe situation the spectator has an opportunity to observe clouds, raised above distant seas, cross his horizon, and proceed to confer fertility on unknown regions. Often does he see them towards sun-set collect under the fantastic forms of castles, forests, and steep mountains;—fleeting images of our world and of human life. At other times these clouds are reflected at his feet in the bosom of a transparent

water, and his imagination is enabled to contemplate at the same time a new region in the sky, and a new sky in the depth of waters. We shall pursue this subject when we come to treat of the harmonies of light and air; at present we proceed to discuss the farther relations of air to the earth, to vegetables, to animals, and to man.

Aërial Harmonies of the Earth.

THAT part of the earth which comes first under our observation in this department of our subject is sand. Sand is formed of the wrecks of marl, rocks, shells, and pebbles, reduced in progress of time into powder by the perpetual action of the waters of the sea. Sand is formed in vast quantities, both in the advanced part of the bed of the sea, and on its shores. You meet on the latter with immense tracks of grey, yellow, reddish, and even white sand; and the eye of a naturalist may there recognize the primary part of the different materials contained in the bosom of the earth. If the winds carry to the summit of mountains the clouds which prove the source of rivers, it sweeps thither in like manner a portion of the lighter kind of earth, as a counterpoise to the incessant drain of soil from the high ground by streams. It is no more beyond the power of wind to transport the materials of a mountain, particle by particle, from the sea-shore to the summit of the Alps, than to carry drop by drop, from the bosom of the Ocean, that water which forms immense blocks of ice, and feeds the copious streams which flow towards the plain. The physical, like the moral world, is under the

guidance of invisible powers, and the limited observation of man extends only to the consequences. Were we attentive to the general harmonies of nature, we might say, on beholding the clouds carried by the west and south winds in winter to the upper part of the atmosphere, "Behold portions of the Rhone, the Rhine, and their glaciers." We might say likewise, on seeing the clouds of dust raised by the north and east winds in summer on our highways and on the sea-shore, "Behold a portion of the sandy substance of their banks." Whence could have come that portion of sea-sand which enters into vegetable earth had not the action of the wind brought it from a considerable distance? There is, therefore, nothing ridiculous in speaking of sand and earthy substances being conveyed by the wind in the same way as water. Without speaking of the storms of Lybia, which swallow up whole caravans, or the whirlwinds of the northern provinces of China, which oblige the inhabitants of Pekin to cover at certain seasons their face with a crape on going out of the house; nor those of the borders of the Caspian Sea, where the sand is of so fine a powder as to give rise to the Turkish proverb, that it penetrates the shell of an egg; nor those which I have myself experienced at the Cape of Good Hope, where, notwithstanding a

double set of panes and window-frames in each house, the sand finds its way into the interior apartments, and is even tasted in every article of diet. We may form some idea of the existing quantity of this volatile dust by what we see in the case of rooms which have remained for some time unoccupied. Though kept carefully closed, our furniture soon bears the marks of this dust, which settles on the top of every wall, on the cornices of the highest towers, and even in the crevices of the stones, where it keeps up the vegetation of moss, of pellitory (*parietaria officinalis*), of the wall-flower, and even sometimes of trees. Nature had no doubt contemplated these results when she framed the seeds of the maple, the elm, and of a variety of plants which thrive on a rocky soil, so as to admit of being conveyed from one spot to another, and to take root in the most uninviting situations. This holds among others in the case of the seeds of the cherry-tree, the kernel of which is too hard to admit of digestion in the stomach of an animal.

The earth re-acts on the air likewise by means of mountains, the inequality of which is one great cause of the variety of winds, the vallies operating in many situations as funnels. When mountains have become warmed by the sun, and the surrounding air is dilated, the winds take a

direction towards them, and continue to blow in that way during a part of the day. These effects are chiefly perceptible along the sea-shore in the torrid zone. Two or three hours after sun-rise, when the earth begins to be warmed by its rays, the prevalent winds of the Ocean quit their accustomed course, and blow towards the land, where they bring the most agreeable freshness to the atmosphere. These breezes are felt all along the coast of Africa, and around the islands situated between the tropics. They bring to that burning climate, not only the fresh air of the sea, but the rain necessary to the renewal of streams and of vegetation.

It is thus that Nature balances by means of re-action the effect of her general laws, and enables every latitude to participate in the harmony of the elements. She opposes to the condensation of the frozen atmosphere of the pole the dilatation of the warm atmosphere of the torrid zone; while to the general course of the trade winds prevalent in the open sea, she opposes particular winds which blow along the coast. Her works are throughout consistent and harmonious. The sun gives, by means of his heat, the trade winds as general currents to the atmosphere as well as to the ocean; and he raises the land breezes like eddies in an opposite direction. These land

breezes have a flux and reflux in the same way as tides, blowing from the sea towards the land during the day, and from the land to the sea during the night. Both undergo variation according to the course of the sun. Without entering farther into the theory of the air on this occasion, I shall merely add that there are hollow mountains which send forth winds as if they were generated in their sides. Of this description are the Eolian mountains of Italy. These effects, apparently so difficult of solution, are accounted for by the action of the sun, which heats the mountains, dilates the air contained in them, and drives it out during the day; but this air re-enters on being condensed by the coolness of the night. We shall soon have occasion to observe that there are, in other countries besides Italy, Eolian mountains which send forth air without being hollow. These generate winds by the shape of their vallies and the density of their atmosphere, on which the sun acts as on the atmosphere of the poles. There are likewise frozen mountains, by means of which the sun produces general currents of flux and reflux in the lakes at their bases, exactly as he produces in the ocean by means of polar ice. Mountains are not mere accumulations of earth, nor were they casually formed by the power of water, as is too commonly imagined. Some of

them harmonize positively and negatively with the elements; some are solar, volcanic, Eolian, hydraulic (which attract the water), litoral, metallic, vegetable, &c. We shall enter more fully on them when we come to treat of terrestrial harmonies.

Air produces a number of harmonies, not only on the surface, but in the interior of the earth. Trees by means of their roots, and animals by means of their labours of different kinds, introduce air to a considerable depth under ground. The earth-worms, the beetles, the moles, the rabbits, &c. scoop out a number of holes in the ground, while the vine extends its roots across the hardest quarries. The roots of trees not only make the air communicate in this manner with the ground, but they likewise absorb it, as otherwise their vegetation could not go on. The air is contained in these places in ranges of calcareous stones, which, though apparently compact, are filled with small hollows and with shells, which, in like manner, contain air in their cavities. But it abounds particularly in layers of sand, where it fills up the almost infinitely small interstices between the grains. It is only by means of this air that water finds as ready admission into sand as into capillary tubes. Sand is a kind of sponge, replete at once with air and water, and adapted to

keep up the circulation of these elements in the interior of the globe. The inflammation of pyrites at a great distance below the surface of the earth can take place only by means of air, which decomposes and kindles them. No fire can exist in any situation without air. It is to the operation of this subterraneous atmosphere that we are to attribute volcanoes, earthquakes (arising from its dilatation), the circulation of interior waters, along with mineralogical compositions and decompositions. Finally, to this cause we are to ascribe the temperature of the globe, which is found to be of about ten degrees of Réaumur's thermometer (about fifty-five of Fahrenheit), at the bottom of all mines, the same as at the bottom of the sea. It is by means of this subterranean air that the heat of the sun penetrates into every part of the earth, and shows itself even under the glaciers, from which streams of water flow in winter, while in summer their bases are melted to a considerable extent.

I have occasionally seen in severe frosts the pavement, and even the thresholds of doors, raised in such a manner as to lose the level of their surface. This is caused by the dilatation of water, or of the ground in consequence of the expansion of the air contained in it when the freezing begins. It is ascertained that water in-

creases in size on being frozen; but as it, on the other hand, increases its size on being dilated by heat, (as is apparent from the tubes of our thermometers, which contain frequently more water than spirit of wine,) I have been led to the following conclusion:—that the cold acting in winter on the upper layer of the ground, which is penetrated with water and air, must dilate the whole northern part of our hemisphere, and increase its height; while heat dilating in a similar manner the ocean in the torrid zone, the general level of the earth is kept as before, and the waters of the south pole have always the same inclination towards the north pole. The whole earth, it is clear, must be subject to the contractions and dilatations occasioned by the air contained within it, and it is probably to this cause that we are to attribute the rupture of so many rocks, the fragments of which are scattered on its surface. We shall take an opportunity, when treating of terrestrial harmonies, to expatiate at greater length on this new and interesting topic. Philosophers have devised various systems to explain the formation of the planets; but I should be very glad could they, without going out of the limits of our globe, inform us why so many stones, flints, and rocks, are splintered, and lie scattered throughout almost every part of the world.

Slings were the first arms of men, and stoning the first punishment; for in no situation are men at a loss for the means of inflicting injury on each other. Were it the effect of attraction, of water, or even of the progress of time, to give a round or smooth surface to substances, our rocks would not be so sharp pointed, nor our mountains so rugged. We shall subsequently endeavour to trace the origin of that which wears the appearance of universal ruin, but which to me seems nothing but the result of that harmony which preserves the world by reproducing it. The same causes which operate towards the formation of minerals have a tendency to dissolve them.

The earth is not only in connexion with the air below and above its surface, but its interior parts maintain a similar relation. The hardest marl contains a multitude of pores, and a microscope enables us to discover a variety of them in metals of the finest polish. Some idea of the effect of a microscope may be formed by a drop of water in the midst of a flower, when it makes us perceive those nectarine glands which are imperceptible to the naked eye. We sometimes find after a fog these drops of water suspended like seeds of pearl on a spider's thread, and shining in the sun with the colours of the rainbow. They have the effect of increasing sur-

prisingly the bulk of the unlucky insect of a still more brilliant colour than themselves, which is suspended from this slender web. An idea of the telescope, and of its power of magnifying objects at a distance, may be formed from the effect of a transparent cloud in increasing the size of the moon on the horizon. Our discoveries in science have proceeded, not from the invention of theories, but from that gradual expansion of our knowledge which is consequent on an accurate survey of the works of Nature.

Some microscopes are of so high a power as to make objects appear six thousand times larger than they are. In the solar microscope a flea looks larger than the natural size of a sheep; yet even that instrument cannot render an elementary particle of air or water perceptible to our eyes. How then should it enable us to perceive the fluid which surrounds the loadstone, and which attracts to it particles of iron from the distance of several inches? This magnetic fluid, moreover, acts incessantly around the loadstone, and undergoes no diminution from its uninterrupted communications. It attaches itself to all particles of iron which come in contact with it, and confers on them a similar virtue. It seems to partake of the nature of fire; but, on the other hand, it requires nothing to keep it a-going, or at least does not

consume whatever serves to animate it. Moreover, it becomes separated for ever from its loadstone by the operation of fire. If the magnetic fluid is a corporeal substance, how does it happen to be invisible and intangible like a spirit? And if it is a spirit, how has it the property of attaching itself to bodies, and making them move? Its existence is sufficient to show that there are principles of movement which are active in themselves and are united to bodies, while they elude the observation of any of our senses, and even our reasonings. Why should there not, likewise, be principles of life and intelligence existing by themselves, which fasten on matter, organize it, and confer on it the power of moving, propagating, and reasoning? That such principles exist there is no doubt, since there are material beings organized so as to move, propagate, feel, and reason, without being any thing but mere matter when separated from the soul that animates them. If all the arts of man are only feeble imitations of that nature which we see, Nature herself is but the result of principles that we do not see: we are surrounded by air, attraction, electricity, magnetism; by organized, sentient, and intelligent beings, all invisible as far as regards their essence, and manifested to our senses only by being combined with substance. They

exist, however, as much independently of substance as substance independently of them. Some there are, no doubt, of a higher class, which escape the observation of our senses, and which are rendered perceptible to our reason by the nature of our mental constitution. Such is that Being who formed the harmonies of this Universe, and supports them for us, creatures of transitory existence. His perpetual enjoyments are not to be scanned by our feeble imaginations; they must be boundless, like his power and his duration. Let us then rest assured that this world is, as Plato long since taught, nought but the fugitive shade of another world, inhabited by beings invisible to mortal eye, but greatly superior to ourselves.

Aërial Harmonies of Vegetables.

If the hardest metals are found to have a relation to the air, and to other elements of still greater subtilty, vegetable products possess similar relations to a still greater extent. Repeated experiments made by able chemists, among others by Homberg, prove that air becomes one of the solid materials in the composition of plants. The oak is found to have a third of its weight composed of air; and it is the action of fire that separates this from the rest. On burning a log of wood, we often hear a continued noise and crackling, which is nothing else than the escape of the inclosed air. Peas are found, in like manner, to have a third of their weight composed of air. Now it is well known that a globe of iron, or the hardest substance in the world, could not compress the tenth part of their weight of air without bursting; nor could a condensation to the degree just mentioned as existing in wood, be produced by any human power. Yet this the rays of the sun, light as they are, are sufficient to accomplish: these rays both collect and separate elements in a way which we should in vain essay to imitate by means of our philosophical instruments; they may be called the shuttle

which weaves the web, and the scissars which cut it; operating in each case with a nicety calculated to prove that Nature can be effectually studied only in her own works.

Vegetables have evidently harmonies with the air by their respiration. On rubbing a living plant with oil, we cause its almost immediate death; while a similar operation is found to preserve a piece of iron from the rust which threatens it. Hence an essential difference between the metal and the vegetable, the latter possessing organs of respiration, which are not in the former. Plants have tubes by which the air is communicated throughout their whole interior. Malpighi was the first to make this discovery, and to give these tubes the name of tracheæ. "They are," he says, "vessels formed by the different contours of a very thin blade, broad, elastic, and flat, which being rolled on itself in a spiral line, like a cork-screw, forms a pipe of considerable extent, divided throughout its length into several little cells. These blades consist of several pieces divided by scales like the tracheæ of insects, from which their name is derived. On tearing one of these little vessels, we discover that they have a kind of peristaltic motion."

Hales, in his work entitled "Vegetable Statics," observes that the spiral turn of these

small vessels is in a direction contrary to the diurnal motion of the sun. This observation is of importance, and confirms what I have ventured to advance in regard to the influence of the sun on all the powers of nature, of which he is the grand mover. The springs, or smaller particles of plants, appear to be affected by his daily course in the same way as their harmonies are affected by the annual revolution around him. A farther research would perhaps lead to the discovery of a different arrangement in the spiral part of the tracheæ of night flowering plants; I mean of those which open their flowers only during the night, such as the jalap, a species of convolvulus, and the *arbre triste* of the Moluccas, which have, no doubt, lunar harmonies suited to the nature of their growth.

Be this as it may, we have no difficulty in discovering the tracheæ of plants when we break straight across the tendrils of the vine, or the young branches of a rose-bush or lime-tree, as we speedily discover them in a spiral form of silver colour. When we tear a leaf slowly, the tracheæ may be observed to lengthen, while the portions of the leaf are separating from each other. The tracheæ have a larger diameter than the other vessels of plants, being always placed around woody fibres, and being larger in the roots than

in the stalks. It seems to admit of no doubt that these elastic tubes serve as vehicles of air which they inspire and emit. Their action, stimulated by the sun's rays, no doubt tends to raise and circulate the sap by means of the heat of the air, and the air itself perhaps goes in an elastic spiral, similar to the spiral forms of the tracheæ. At all events, the plant inspires and emits air chiefly by its leaves, which contain for this purpose an infinity of pores or little openings imperceptible to ocular observation. Leuwenhoek relates that he calculated, by aid of a microscope, above 162,000 on one side of a leaf of box-wood.

Plants are always found to seek air and light, those that are raised within doors being observed to turn towards the windows; while such as are excluded from air and light, I mean such as are placed in a cellar, turn gradually white. This is exemplified in the case of the cardoon-thistle, and endive, preserved in winter in cellars; as well as in the case of lettuce, the leaves of which we are in the habit of tying in summer to make them tender. All these artificial vegetables, bereft as they are of air and of the solar rays, are found to possess little substance or strength. A similar remark is applicable to the grass growing under the shade of a tree, which becomes long, soft, and flabby, the cattle generally avoiding it; for which reason it is a rule to cultivate no trees,

not even the apple, in the rich pastures of Lower Normandy. A few plants only thrive in the shade, such as the wood-anemone, which in spring covers the soil with its net-work; and the periwinkle of the woods, an evergreen which bears blue flowers in winter. To these we may add the raspberry-bush of Canada, with its crimson roses; the large convolvulus with white bells, whose shining flowers produce such pleasant effects in the shade; and, above all, the ivy, which covers the soil of damp forests with a carpet which is green even in the midst of snow. These are beautiful varieties, and ought to be more frequently introduced into our gardens in the English taste, where the groves cut off air and light from a number of our plants.

Vegetables harmonize so well with the atmosphere, that they change mephitic air into pure air, as has been clearly proved by the intelligent Ingenhousz. This regeneration is still the work of the sun; for plants, and particularly flowers, when put into a close room, corrupt the air to such a degree as to engender a mortal malady in the person who breathes it, particularly in the night. It is a melancholy truth that females have caught the seeds of fatal disease by sleeping in a room where there was a profusion of lilies. We cannot too much admire the influence of the

orb of day on all the agents of Nature; all their harmonies are suspended or deranged by his absence. Observe how the Author of Nature has himself combined their different effects. Animals corrupt air by perspiration, while the plants destined to their support re-establish it in all its purity. Nay, they do more; for they change the most offensive odours into delicious perfumes. What beautiful roses are cultivated on dunghills; and how disgusting is the soil in which the Paris gardeners raise in winter the sweetest tuberoses.

Vegetables maintain a harmony with the external air by means of their stalks. The side of the stalk exposed to the south wind is considerably more dilated than that which is blown on by the north. This observation may be of use in putting in a right direction any one who had lost his way in a wood; for, on cutting the branch of a tree, he would have little difficulty in recognizing the side looking towards the south, because on that side the distance is greater between the pith and the bark. Even the bark of vegetables is in harmony with the temperature of the atmosphere, being a kind of clothing in which Nature has covered them, and adapted to the climate in which they grow. In a cold climate we find the bark thick, and frequently resinous, as in the case of firs; while in a hot

climate the bark is light and thin. Vegetable products destined to live only during a season, have hardly any covering of this kind, as we find exemplified in the case of grasses which have a sort of epidermis. We have little difficulty in recognizing vegetables growing in windy or exposed situations, by the hardness and thinness of their leaves. The pine, the fir, the cedar, the larch, which thrive on the summit of mountains, have thin and woody leaves; as is the case, likewise, with the wall-flower produced on the top of walls; the leaves, in each case, giving very little hold to the winds. On the other hand, trees and other vegetable products, with large and tender leaves, such as the fig and plantain-tree of the torrid zone, are found to thrive best on the borders of rivulets and under the shelter of rocks. All have their stalks proportioned to the nature of the wind to which they are exposed; the fig-tree consisting of very frail wood, and the plantain being made up of a condensed heap of leaves. Such are the inhabitants of the humble valley. Those again which rise on the sides of mountains, are formed to resist the tempest by the hardness of their trunks, and are capable of supporting without hazard an ample foliage; such are the elm, the beech, and the oak. Trees of light and brittle wood, like the fir and poplar of Italy,

carry their heads in a pyramidal form covered with thin and light leaves. The poplar of our climate supports a large head, and consists of much more elastic wood than the tapering poplar of Italy; the country people being in the habit of applying its pliant branches to the same use as the osier. The palm-trees of the torrid zone grow in situations exposed to all the violence of hurricanes; some on mountains, like the palmetto; others on the borders of the sea, like the fan-palm and the cocoa-tree. All have their trunks formed, not of real wood, but of elastic woody fibres; and their leaves resemble long feathered branches. These leaves, when in a dry state, are used as tablets, and are written on with a bodkin, in the same way as may be done on thin plates of wood.

In speaking of the oblique direction of the winds towards the earth, I observed that they described a curve composed of their horizontal movement forward, and their perpendicular movement downward, the consequence of which is a parabola. I revert to this idea, because it explains the curved swell (*renflement*) in the trunk of the palm-tree; imitated by the Greek architects in a correspondent swell of the column, for the sake not of strength but of ornament. Although naturalists maintain that the palm-tree

differs from all other species of trees in having its trunk of equal diameter throughout, I cannot help thinking that I have perceived in cocoa-trees a swell of the nature just mentioned at two thirds of its height. In a tree a curve of this kind may be conducive to solidity, inasmuch as it presents a buttress to the winds, from whatever quarter it blows. These precautions of Nature to protect palm-trees from the violence of hurricanes appear the more probable, when we pay attention to her evident solicitude for other vegetable products in the same climates. I have seen, in the Isle of France, a tree on a rock, into which its roots must have had the greatest difficulty in penetrating; the trunk of which was surrounded by long ribs like broad planks, which conduced materially to its support. These ribs were, when near the ground, above seven feet in breadth, and they rose along the stalk of the tree to a height of more than fifteen feet, leaving between each other intervals all around, out of which one might have made as many little cabins or lodgments. The extremities of the branches of this singular tree sent forth a number of vegetable cords, which, falling to the ground, took root there, and became, in course of time, a kind of trunk, supporting, not only the branches which had produced them, but even rising higher

than them. Father Dutertre describes a similar one which he saw at Guadaloupe, the ribs or buttresses of which extended to a distance of thirty or forty feet from the bottom of the tree. His ecclesiastical superior projected, he says, the construction of a convent, formed in chief part of these live materials, with cells, a chapel, and a refectory; but the notion was relinquished on account of the dampness of the roots. He calls this an "admirable fig-tree," and well did it deserve the name. The ends of the branches of that which I saw at the Isle of France were loaded with figs hanging down to the ground; but its fruit had very little taste.

Nature is not satisfied with these precautions for the protection of vegetable products against the rage of hurricanes: she fortifies the borders of forests with strong lianas, a creeping plant, sometimes of the thickness of the leg, with a bark which is elastic and strong as leather. It requires the application of a greater force to burst asunder this plant than to burst a hempen cord of the same thickness. These lianas rise from the bottom to the top of trees, from which they re-descend, interwoven with neighbouring trees; and fastening the one to the other, like cordage, make them invulnerable under the greatest agitations of the atmosphere. Nothing short of this

is wanted in the forests of the torrid zone, where the hurricanes, which make up for the absence of winter, destroy in one day legions of insects that had been in progress of multiplying throughout the year. These visitations, while they shake the oldest trunks of the forest, overwhelm ships at sea, and overset many monuments of human power on shore; still their mighty voice announces, in the midst of the havock, a Providence careful of its own work; for, while the towers totter to the ground, the tree regains its posture and is preserved.

If Nature has provided for the security of the forest, she has not been unmindful of that of the meadows, whose humble products have, like trees, their aërial harmonies. Grasses, the most common of these products, have thin and supple leaves, which give very little hold to the wind; their lowly stalks being elastic, cylindrical, and fortified from space to space with knots. They lean against each other for support without receiving injury, and when the rage of the tempest passes over them, they are seen to bend and recover their position, with an undulation similar to that of the waves of the sea. Those which, agreeably to the just expression of our celebrated fabulist, are "produced on the humid borders of the kingdoms of the wind," have either leaves

lying along the surface of the water, as in the case of the nymphæa, or standing erect in pliant blades, as in the case of reeds. Yet the oak, notwithstanding the precautions of Nature, is often overthrown by the tempest, while the reed is preserved by its weakness; a faithful picture of the conditions of life so admirably illustrated by the amiable La Fontaine.

The aërial harmonies in regard to the growth and preservation of plants are, no doubt, just objects of admiration, but those connected with their decay are equally so. It is remarkable that the dry stalks of those kinds of grass which die once a year, as well as the leaves of the trees which fall to the ground at the end of autumn, are found, notwithstanding their weakness, to resist wind, rain, and snow, which make such ravage on human habitations; but all decay in spring. The husks of beans and peas; the bunches of the sumach, service-tree, and privet; the bay-berries, and a quantity of other seeds, remain suspended during winter to their stalks, and serve for food to the birds. They do not burst or fall until the season when they are about to be renewed. The straw of the grasses, and the trunks of decayed oaks, are accordingly found to decompose themselves in the very different periods which they respectively take to

vegetate; the first in the course of six months, and the latter in the course of centuries. The withered tree continues erect for a long time, while Nature, throwing every where a veil over death, covers the arid branches with perfumed garlands of honeysuckle or verdant ivy. If the tree happens to be overthrown by a storm, we see agarics and mosses of various colours at once devouring and decorating its extensive surface. What power has then proportioned, in every vegetable, the strength of the living fibres to the injury of the atmosphere, and the duration of the decayed fibre to that of its revival? It was doubtless that Power which willed that the earth should not be incumbered by the mass of undecayed vegetables, while, on the other hand, it saw good that they should remain in existence a sufficient time to afford shelter, nourishment, and a bed of repose to animals during winter. We see here the hand of that Being who has established a harmony between the different periods of human life, between the ignorance of childhood and the experience of age.

Who is capable of describing the movement communicated by the air to the various classes of vegetables? How often have I at a distance from towns, in the bottom of a solitary valley surrounded by a forest, seated on the border of a

meadow, taken delight in observing the gilded melilot, the purple trefoil, and the verdant grass, forming undulations similar to the surface of the water, and presenting to the eyes a waving sea of flowers and verdure! While thus immersed in contemplation, the winds waved over my head the tops of majestic trees, and the altering position of their foliage gave a variety to the aspect of the verdure which they displayed. Each tree has its peculiar motion. The sturdy oak bends only in its branches; the elastic fir shakes its lofty top, the stout poplar moves its light foliage, while the birch lets its leaves shake in the air like locks of hair. The spectator is inclined to imagine that the motion of the trees bespeaks the influence of sensation; one bending to its neighbour as to a superior; another extending a friendly embrace; while a third is convulsed as if in the presence of an enemy. We sometimes see a venerable oak raise, in the midst of other trees, its long branches immoveable and stripped of leaves; we are led to contemplate it as a sage, the son of an age that is past, and a stranger to the feelings which agitate the existing generation. Now and then a grave and melancholy sound is heard to proceed from those venerable bodies, like the confused murmur of a people assembled at a distance. At other times, the murmurs of

the forest are accompanied by the accents of the nightingale, who from his nest puts up prayers of gratitude to the goddess of love. The rustling of the trees serves to display the shrill sounds of other birds, as a gentle verdure sets off to advantage its brilliant covering of fruits and flowers.

This rustling of the meadows, this warbling of the woods, have charms which to me are preferable to the most attractive music. My soul gives itself wholly up to the impressions which they are calculated to excite, sinking along with the waving foliage of the trees, and rising again with their summits towards heaven; it transports itself to the seasons which saw those plants take root, and to those in which they are destined to perish. These trees extend my fugitive existence into an infinite space, and seem to speak to me, like the oaks of Dodona, in a mysterious language. Majestic forests, peaceful solitudes which have often calmed the passions which agitated my breast, may the cry of war never disturb your murmuring glades! May your sacred rustling be accompanied only by the sounds of the feathered tribes, or by the gentle language of friends and lovers, who come to seek repose under your shade.

Aërial Harmonies of Animals.

THE air penetrates into the bodies of animals and into their muscular interstices, in the same way as into plants; it promotes the motion of the fluids, and by its elasticity prevents their flesh from being overloaded by the weight of the atmosphere. When we make a vacuum on a part of their bodies by means of a cupping-glass, (a vase from which the air is expelled by means of heat) the flesh is seen to rise in the cupping-glass in consequence of the expansion of the air contained in it, the spring of that air having no longer a counterpoise in the exterior air. A similar effect is produced by the suction of the mouth on the hand, to such a degree sometimes as to make the blood spring out. There are small vesicles of air scattered between the muscles of animals and their skin. The Japanese attribute, with considerable probability, a number of diseases to the stagnation or putrefaction of this inward air, and are frequently induced to make trial of puncturing and cauterizing as remedies. They are in the habit of puncturing the spot supposed to be the seat of the complaint with a golden probe, or they cauterize by means of moxa, which is nothing else than the down of a

species of mugwort. The surgical operations of a people always bear marks of the national character: that of the Japanese is cruel, like themselves; but Nature by no means desires us to attempt the cure of a complaint by the infliction of pain. This remark holds true in a physical, a moral, and even in a political sense; it is a truth which I shall repeat more than once on account of its novelty and its importance. The Greeks and Romans, who were fierce only when guided by ambition, and whose manners were fundamentally mild, had the practice of seeking in warm baths and frictions a cure for the complaints to which the Japanese apply such rude processes. The Hindoos, the mildest of mankind, employ still gentler methods, being accustomed to have their fleshy parts rubbed or kneaded, if we may say so, by the hands of children. Such at least is the course by which they profess to cure and even to prevent rheumatism.

Our refined theorists have not paid sufficient attention to the operation of interior air on the human body. It seems very likely that the lightness and suppleness of our members ought to be attributed to its purity and circulation; while we may ascribe to its stagnation and deterioration, pain and heaviness in the head, rheumatism,

gout, and palsy, as well as diseases in our humours, and most fevers engendered by bad air. It is beyond doubt that whatever air there is in the interior of our body is formed partly from the air in our lungs, partly from that of our nourishment. This air must perform a very important part in the animal economy; and it is that which after death, when heated by putrefaction, expands the flesh, decomposes the fibres, and spreads the miasmata to a distance. It deserves to be remarked that dead animals undergo the process of destruction, when exposed to the air, much sooner than dead vegetables. It follows that the time of the dissolution of organized beings is not regulated by that of their growth, as we might be inclined to think by the time required for a decomposition of most plants. This time then in animals seems to bear a proportion to that which is required for a repetition of the supply of food; animals in a fasting state being already in a disposition to putrefaction, and famine of every description being followed by epidemic complaints. There is however a moral reason for the rapidity of the process of dissolution in animals compared with vegetables, Nature having always rendered physical causes subservient to moral accommodations. Plants were made for animals, and it was consequently necessary that

they should subsist sufficiently long to be of use to them, even when vegetation does not go on, as is the case in winter. A number of fruits are consequently preserved in life without receiving nourishment. But an animal differs greatly from a plant in being gifted with sensation, and in being inspired throughout the course of existence with a desire to prolong it, and a dread of losing it. It seems accordingly suitable to the arrangements of Providence that living creatures, entertaining such an apprehension of death, should not be alarmed by the long continued sight of a dead body. Putrefaction consequently takes place very soon, the confined air dilating the body, and the effluvia attracting clouds of insects and birds, who leave nothing but the skeleton, while carnivorous quadrupeds devour even the bones.

The action of the confined air arising from a dead body induced the ancients to consider the souls of animals, and even those of men, to be of an aërial character. Virgil, in describing the death of a warrior, frequently uses the expression *effugit in auras.* Now were our souls, or those of the brute creation, nothing else than living air, it would be a very easy matter to do what will appear an odd operation to my readers, I mean to receive and compress them into phials at the

moment of separation from the body. But it would be beyond our power to enclose in this manner a ray of the sun which enables us to see every thing, or a particle of his attractive power which gives motion to the universe. How then should we expect to succeed in compressing immaterial essences, souls which are capable of feeling, foreboding, desiring, and reasoning? Doubtless they belong to other worlds than that which is the scene of our transient existence, and a knowledge of them belongs to minds differently constituted from ours. In all our scientific and mechanical arrangements, we have succeeded in becoming acquainted with the outside only of the great edifice of Nature; we are incapable of ascertaining its foundations or its superstructure, much less its interior formation; we have as yet scarcely acquired the power of comprehending its most ordinary elements.

Animals are in harmony with the external air by the processes of inspiration and expiration. For this purpose Nature has given them organs which she has refused to plants, viz. nostrils and lungs. The trachea (or wind-pipe) of plants resembles only the aërial vesicles of the muscles of animals, and the pores of their skins. There is no animal without two nostrils, and it is proper to observe that the organs of animals are double,

with the intention that the one shall supply the place of the other in the event of accident. The two nasal conduits are not parallel, but diverge a little, for the purpose of giving more scope to their action. With the same intention the visual rays of the two eyes proceed from two optic and diverging nerves which meet in the same centre, while the rays crossing each other on the outside, diverge and embrace a larger portion of the horizon than if there were only one of them. In the case of the nasal conduits there is no crossing in the respiration; but there is a divergence for the sake of giving more latitude to their concurrent operation on the olfactory nerve. Our observations on the sense of smell shall be delayed until we come to speak of the vegetable harmony of animals. At present we treat of respiration only, which has not hitherto been reckoned one of the senses, although the most necessary of all to existence, and the first, as it is the last, in activity. A similar remark might be made on other faculties entitled to rank as senses, although naturalists have thought proper to confine their number to five—sight, hearing, smell, taste, and touch.

Though all animals have not the sense of smell, respiration is common to all, air being necessary to their existence, and death ensuing when they

are deprived of it. Some insects indeed live a long time under the air-pump; but this is owing to the pump not extracting the air completely from the receiver, and to a small portion being sufficient to keep insects in life. In like manner a very slender ray is sufficient to enlighten them, as we see in the case of bees when at work in their dark hives, and in the case of ants in their cells. Nature has created beings capable of extracting advantage even from the wreck of her elements. That insects depend decidedly on breathing for their existence is evident from their perishing immediately when we close up their tracheæ with oil; a circumstance which has suggested the practice of anointing our bodies with an oily or greasy substance, as an effectual method of warding off their attacks. This plan is adopted, not only by the American savages, who are in the habit of painting their bodies with rocou ground with castor oil, but by some of our European neighbours, who have recourse to oily substances to keep vermin from their hair.

Nature has employed a great variety of means to enable animals to breathe even in the ground and under water. The principal of these are the tracheæ of insects and the gills of fishes. The tracheæ or stigmata discovered by Bazin and de Géer are openings on the outside of the body of

the insect. In the case of flies, these openings are in the breast and in the curls; the silk-worm and several caterpillars have no fewer than eighteen along their bodies; while the mole-cricket, which lives under ground, has twenty of them. Some worms have the tracheæ at the end of a small horn. From these openings there proceed inwards a number of small tubes formed of a silver thread rolled upon itself like a gun-worm, as is the case in the tracheæ of plants. These conductors branch out into a variety of ramifications, and convey through the body of the animal, as well as of the vegetable, the air which finds its way out by the pores of the skin. Aquatic nymphæ have their respiratory organs, not in stigmata, but in a quantity of fibres, which they play with surprising facility. It is remarkable that, while the tracheæ of plants have their spirals turning in a direction contrary to that of the daily motion of the sun, spiral shells have likewise their volutes turned in the same manner, with the exception of a small number, called on that account *unique*. The probability is that the action of the sun is directed first on their tracheæ, and subsequently on the spirals of their shells. Such coincidences as these put beyond a doubt the original influence of the sun on all departments of the vegetable and animal creation, whe-

ther their aërial spirals be considered in correspondence with the rotatory motion of the earth towards the east, or in opposition to the apparent motion of the sun towards the west. Besides, it is very well known that the diurnal motion of these two bodies produces a spiral curve when combined with their annual motion.

Fish derive air from the water, which they are incessantly swallowing through the mouth, and throwing out by the gills. The gills are formed with infinite skill, and may be called a delicate kind of sieve adapted for separating air from water. Their operation proves the radical difference between these two elements, and leads to the conclusion that they are not joined even when mixed. The gills are placed in the back part of the sides of the head, and are contained in a cavity adapted for them. They are a kind of red and flexible leaflets, consisting of a row of thin plates like the blade of a knife pressed against each other, and forming a succession of barbs or fringed substances similar to those on the side of a goose-quill. These gills are covered with a small lid, and with a membrane supported by cartilaginous threads. Both are capable of being raised and lowered; and, by being thus opened, afford a passage to the water swallowed by the animal. A prodigious number of muscles give

motion to these minute particles. It may appear almost incredible that the number of particles connected with the respiration of the carp is not fewer than 4386. Of these sixty-nine are muscles; while the arteries of the gills, in addition to eight principal branches, throw forth 4320 smaller ramifications, while each of the latter gives birth to a number of cross arteries. Add to this that the quantity of nerves is not smaller than that of the arteries; and that the veins are divided and subdivided, like the arteries, into 4320 ramifications, which differ from the arteries, inasmuch as they do not give rise to any transversal capillary vessels. In this manner the blood flowing from the heart of the fish is spread over all the plates or blades of which the gills are composed; so that a very small quantity of blood is exposed to the action of the water, for the purpose, no doubt, that each part may be easily penetrated by the particles of air detached from the water.

It is not easy to explain in what manner these particles are detached from the water by the operation of the gills; but there seems no doubt of the fact, nor of the redness of the gills being a consequence of the operation of the air. That redness is exactly similar to the vermilion of the blood in the veins of animals with lungs, a ver-

milion considerably brighter than that of the arteries.

It is to the celebrated Duverney that we are indebted for the anatomy of the gills of the carp, of which I have endeavoured to give a brief description. Notwithstanding my deficient knowledge in respect to the primary channels provided by Nature, I cannot help observing that if to the 4320 ramifications of the arteries and veins we add the eight principal branches, along with those of the sixty-nine muscles of the carp which are instrumental in promoting its breathing, we shall have a number nearly approximating to that of 4386, which constitutes the number of bones and particles of bones in its composition. If to these we add the subdivisions of the ramifications of the arteries, we shall discover new connexions with the small fibres which compose each of the bones. The purpose of these observations is to afford an additional example of the correspondence existing in vegetables between the tracheæ and their woody fibres, which, as we have already seen, are of similar number, as they are joined together; and it may serve to make known those which exist between the different parts of the lungs and bones of animals; for the air communicates in the interior of their bodies with the aponeuroses of their muscles in the way

which we have already pointed out, and on which we shall enlarge farther on coming to treat of the lungs under the title of the "Aërial Harmonies of Man."

There is no doubt that fishes extract air from water by means of their gills, since it is through them that they renew the air of their air-bladder. This bladder is an oblong bag, consisting of two or three membranes easily separated; sometimes it has only a single lobe or cavity, as in the case of pikes, whitings, trouts, &c.; at other times it has two lobes, as in the case of barbel and carp; three, as in that of the sea-tench; or four, as in the Chinese gold-fish. It is by expanding or compressing this bladder that the fish occupies more or less space in the water, becomes more or less heavy, and ascends or descends as he chooses. The division of the bladder into different lobes has proceeded from a very sufficient reason. When the bladder has only one cavity, as in the case of fishes of prey, the motion of ascent or descent takes place slowly, and without a break; because, as they compress the whole bladder at once, the whole body is moved horizontally, upwards or downwards, as the case may be; a circumstance which has the effect of lessening, in consequence of the resistance of the water, the swiftness of those tyrants of the deep. When the

bladder has two lobes, as in the case of the carp, which lives on insects, that fish, by expanding the anterior and compressing the posterior lobe, rises rapidly with the head foremost to the surface of the water, or sinks to the bottom with equal expedition by compressing its two lobes in different ways. The consequence is an increased promptitude of movement, and additional means of escaping from its enemies. When the bladder has four lobes, as in the case of the gold fish, that fish is thus enabled to vary greatly its contractions and expansions. It rises, sinks, bends, erects, or turns itself in a thousand ways, and plays in the water like a bird in the air. It displays all the richness of the colours of gold, silver, or purple, with which Nature has adorned it. Its attitudes are so graceful, and its movements so varied, that the Chinese, from whom we originally received it, are said to pass whole days in looking at it in the basins of the fountains in their gardens, or in crystal vessels. It is evidently indebted for the ease and grace of its motions to the modulations consequent on the four divisions of its air-bladder.

Flying insects have a considerable analogy with fish in several respects, as I have pointed out in the Studies of Nature: they have in particular a vesicular body, which they appear to contract on

flying downwards; for they keep on the wing so long, and with so much ease, that they seem to be in equilibrium with the air, as fish are with the water. This air is perhaps somewhat lighter than atmospheric air; at least I am induced to think so by the infectious smell exhaled by several species of beetles after death. I gathered one day on a tuft of Julian flowers a dozen of *buprestes*, or beetles similar to Spanish flies. I exposed them to a burning sun in a vase, and covered them with a glass; they died in the course of a couple of minutes; and when I proceeded to uncover them, I was almost suffocated by the fetid vapour arising from the vase. This air seems of the same kind as that which is exhaled by ants and bugs; it gives a kind of support to the insects that have no wings, so that they fall from a great height without receiving injury. I am, however, inclined to think that flying insects have, independently of their air-bladders, a water-bladder which puts them in a counterpoise with the air, as fishes have an air-bladder calculated to put them in equilibrium with the water. I am induced to adopt this idea by observing that when a gnat has sucked the blood with which it is fed, and is loaded by this new weight, it never fails to pass a drop of water by the *anus* before taking wing. This, it might be imagined, is a conse-

quence of the blood that has just got into the intestines; but the same thing takes place whenever it happens to be caught. It takes place likewise to flies whenever they are held by the wings; and they no doubt expect to escape by thus reducing their weight.

Be this as it may, Nature has established an admirable harmony between all its elementary and organic laws, and has extended along the shores of the ocean and the interior of continents, vast tracks of flying sand for the purpose of replacing the progressive reduction of the summits of mountains. As this sand in summer fills the atmosphere with clouds, Nature has given to the eyes of quadrupeds not only eye-lids for the purpose of opening and shutting them at will, but likewise eye-lashes, the hairs of which, being horizontal and very closely set, defend them, like so many little palisadoes, from the dust. Most birds, particularly those which fly in a high and pure atmosphere, have eye-lids to shade them from the light, but they have no eye-lashes. Fish, on the other hand, destined to exist in a quarter where the sun's rays have hardly any action, have their eyes unprotected by any such covering. Insects are similarly circumstanced, because in general they pass their lives in the shade; but as they inhabit the lower part of the

atmosphere, which is full of volatile sand of a nature to surcharge their delicate bodies and stop up their tracheæ, Nature has devised for their protection a very ingenious mechanism, by affixing lashes to the end of their feet. On observing a fly asleep, you will perceive it sometimes covered with dust; but it has no less than six feet, of which the first two and last two are provided with little brushes at the ends. With this the fly cleans alternately its head, its breast, and its tail. The legs in the middle have no such brushes, as their position would prevent the application of them; so that these legs are chiefly useful to support the fly when the others are in activity. Beetles and May-bugs have no brushes to their feet; because their wings, similar to the finest gauze, are covered by sheaths, into which they are folded with admirable nicety. Sheaths are necessary, because these insects generally make their way into the ground to deposit and hatch their eggs. In some of them the outward coat is covered with a perfumed oil, as in the case of the dung-beetle, which, by means of this unctuous matter, is enabled to penetrate into the dung of animals without defiling itself, or without even injuring the beauty of its robe of blue purple. One species of these insects, called, on account of its chesnut colour, the capuchin, penetrates

into the middle of a heap of cow-dung, and descends no less than eight inches, where it is found with its young on its back; for it is viviparous. In that position it braves the winter along with its little family.

I may perhaps be accused of entering into too many details; but a reproach of this nature is applicable chiefly to those who describe the works of man, a detail in the works of Nature presenting us always with something new. Nature, says Pliny, is great in large things, but still greater in the smallest. It is by descending to a minute investigation of the latter that we succeed in discovering her immensity; insects in particular display all the skill of her admirable arrangement. The little trunk of a fly discovers more ingenuity than that of an elephant. We admire the strength of wing and the bold soar of the eagle; but the wings of flies are constructed with still greater skill. The common fly, feeble as it is, lives, without any defensive armour, in the midst of dangers of every kind, and takes a flight which for its portion of strength is both bolder and longer than that of the bird of Jove. It describes a thousand curves in the air by alternate rising and falling, or it hovers over the same spot, and assumes the appearance of being immoveable. The lightness and expedition of its flight enable

it to sport with the wildest animals even when enraged; and, insignificant as it appears, it finds the means of partaking of the repast of man, whose ingenuity has not yet been able to accomplish its exclusion.

It is no doubt more interesting to study the sports of these children of the air in the bosom of the atmosphere, than the convulsions of their lungs under the air-pump. Never inspire children with a turn for such cruel experiments; for when they are barbarous towards innocent animals, they will soon become the same towards men. Caligula, before imbruing his hands in human blood, had made a practice of destroying flies. It may be said that the moral behaviour of man to man commences in some measure with that of an infant towards insects. Never, therefore, let a child acquire a truth by means of a vice, nor extend its understanding at the expense of its heart. Let it not study the laws of Nature in the pangs of sentient beings, but rather in the succession of their enjoyments. Do you wish to show them a proof of the necessity that even insects have for air? Lead them in summer to the bank of a rivulet, and show them the water-spider moving at the bottom of the water in the midst of a globule of air which it has contrived to inclose in its network. Our balloons rise in

the air; but this insect performs a more surprising, and what to us would be no doubt a more useful, exploit, by making its way to the bottom of the water. We find the means of rising by a gas lighter than atmospheric air; but the spider appears to plunge by the aid of a gas that is heavier than water. Point out to children, in the meadows, the multitude of little holes which serve as a retreat to insects, and the molehills, which are afterwards covered with thick grass. All these breathing holes, necessary for the existence of the little labourers within, fertilize the earth by introducing air into it, and perhaps gave country people the first idea of the manner of cultivating the ground. Man has at one time or other derived the most useful instruction from beings apparently the most insignificant.

A number of volumes might be written on the mode of flying of the winged tribes, particularly that of insects. Each species would suggest curious and useful observations by the shape of their wings, the diversity of their movements, and their seasons of emigration. In treating of animal harmonies, we shall see that the primitive genera of animals may be referred to the general harmonies of Nature; but we might refer the winged tribes to these same general harmonies, and multiplying them afterwards by the aërial

harmonies, deduce a number of secondary genera, each of which would have distinct characteristics, and would serve to divide into classes the different species of birds and insects.

We shall here take a concise view of the means provided by Nature for enabling heavy bodies to traverse a fluid so light as air. These means are given them in their wings. The wings of a bird, like the arms of a man, have three joints, and consist of porous and very light bones, with very strong sinews. They are provided with feathers, the largest and strongest of which are known scientifically by the name of *pennæ*, and consist in the lower part of a very light, hard, and elastic cylindrical tube. In the inside is found a dry membraneous pellicle generated by the nourishing fluid to which the feather owes its growth. The upper part of the feather consists of a spongy substance like the pith of vegetables. The stalk, as is well known, is arched and pyramidal. It is furrowed on the inner surface, and covered on both sides with a kind of beard of very light filaments, so compactly joined together, that the air cannot penetrate them. These beards are short on one side of the stalk, and long on the other, so that feather covers feather in the same way as the end of one tile is extended over the adjoining one. Feathers go a great way into

the wing, penetrating even to the periosteum; and are covered at their insertion by smaller feathers, provided for the purpose of strengthening them and preventing the ingress of the air. Finally, the whole wing is fastened by strong pectoral muscles to that part which is the centre of gravity of the bird. The wings are consequently the oars by which it preserves its equilibrium in air; and to enable it to make a progress, they are so jointed as to admit of an oblique movement. Nature has likewise provided birds with a tail, useful in guiding their motions, and consisting, generally, of long straight plumes, with beards of uniform length. A bird's tail is a kind of rudder; for no sooner does it direct it to one side than its head inclines to another, and it changes as it thinks proper, the direction of its flight. Birds with a short tail and long legs, like storks and herons, throw out their feet behind, and make them serve as their rudder, by forming a counterpoise in point of motion with their long neck.

It is by means of striking the air with their wings that birds are enabled to support themselves like solid bodies, and to swim in a fluid much lighter than themselves. Some, like the slow pigeon, manage their wings like oars; others, like the partridge, fly by long springs; some,

like the sparrow, by undulations; while others again, like the swallow, glide along and describe extensive circles over the surface of corn-fields. The lark turns in a spiral direction, and seems to follow the windings of a stair-case in raising itself to the sky; but the real cause of the curve is the delight it takes in looking down on its young brood; and it is observed to sink suddenly into its nest, as soon as it has finished its song.

Of all the flying tribes, those whose flight is the most curious and most within our reach are the insects. Some have wings of the finest gauze, like the fly, which is capable of executing a great variety of motions in the air, as well as of stopping and becoming stationary whenever it pleases; others, like the butterfly, have wings covered with scales as thin as dust, and resplendent with the brightest colours. These wings are four-fold, and fashioned into a variety of shapes, differing very materially from those of birds, which all bear a resemblance to each other, and are distributed by pairs. Butterflies have not tails like birds; but are, in general, provided with antennæ to direct their flight. Their rudder is in their head. A butterfly, with its trunk and its antennæ terminating in a knob like the filaments and anthers arising out of the bosom of flowers, with its quadruple and shining wings

similar to their petals, with its hovering on this side and that as impelled by the breath of the zephyr, resembles nothing so much as a flower on the wing. Some of them, like the pterophoros, fly among grasses, with two wings of a very plain construction, similar to two writing pens. I have often stopped with pleasure to observe gnats, after a shower, perform a kind of circular dance; when they may be observed to divide themselves into troops, which rise, fall, move around in a circle, and cross each other without confusion. Our opera dances exhibit nothing more complicated or graceful, and the spectator is tempted to exclaim, that those children of the air are naturally formed for this exercise; for a kind of song is heard to proceed from them in the midst of their movements. Their throats are not sonorous like those of birds; but their breasts are so, and their little wings, like bows, strike the air, so as to make it yield an agreeable murmur. A vapour arising from the earth is the ordinary scene of their entertainment; but it sometimes happens that a cruel swallow suddenly crosses this gay troop, and devours in a moment whole groups of dancers. The amusement, however, goes on without interruption, the places of the victims being soon supplied, and the whole continuing to dance and sing. I cannot help

remarking that their life is a faithful emblem of our own, mankind being accustomed to beguile themselves with vain illusions, while death, like a bird of prey, passes through them, and devours the one after the other, without causing any material interruption to the mass engaged in quest of pleasure. The curves, described with so much beauty and variety by the winged tribes in the air, are similar to those exhibited by the contours of the finest flowers; and to those of which the stars afford us the first models in their circular forms and in their courses. Even those forms are all, as we shall soon see, combined by a delightful harmony in the different parts of the human body.

How many discoveries have been owing to the instincts and flight of the winged tribes! The ancients believed, and not without probability, that there was something divine in the flight of birds. Columbus, though on the wide ocean, became confident that he was approaching the New World, when he discovered the flight of birds proceeding from one island to another. Villages in arid situations have not unfrequently owed the discovery of a well to gnats hovering over the vapours of a concealed spring; and many a traveller has been enabled by the flight of a bee to discover the honey concealed in the bosom

of the forest. Often, in the middle of the wide ocean, have I admired the rapid and indefatigable flight of the frigate bird, which, after flying the whole day long around our vessel in full sail, returned at night to rest on the rocks, the nearest of which must have been at a very great distance. But the flight of the ordinary bee appears to me still more surprising; for respectable mariners have assured me that they have seen, on the coast of Normandy, bees arriving across the water from the islands of Jersey and Guernsey, situated at a distance of more than fifteen miles. The bees come from those islands to the main land to plunder the flowers, and return to their hive loaded with booty. It is evidently impossible that a bee can perceive its hive at such a distance, and even in the course of this progress it must receive but an imperfect guidance from its eyes. Nor can it rest by the way, since the distance we have mentioned consists in water.

But it is not the deceitful signs of land or sea that guide insects in their course; it is the position of the sun. The bee, working in its hive, may perceive by a feeble light the orb of day through distant clouds, affected by the emanation of vapours from the adjoining main land; and this insect has, perhaps, the instinct of giving itself up to be guided in going and returning by

the land and sea breezes, which reign during summer. They are evidently guided in various respects by the rising and setting of the sun. The frigate bird, which flies to a great height in the air, catches the last rays of the sun after they cease to be visible on the horizon of a ship. These birds are, perhaps, likewise guided by the course of the stars; for I believe I have seen them arrive on the shore of Ascension Island in the middle of the night. Certain it is that a French astronomer, when observing the stars at midnight, perceived, to his great surprise, an eagle crossing the range of his telescope. It appears, therefore, that the flying tribes are guided, not only by the sun in his splendour, but by the reflections of his light transmitted to us by the moon. There are indeed several of them that regulate their excursions in quest of prey, their emigrations, and their loves, by the course of the orb of night.

The organization of the winged species, their instinct and their flight, may be connected with a variety of our wants in social life, and may serve to discover the properties of vegetables; to announce the approach of storms and change of seasons; as well as to point out islands beyond the view of the navigator. The flying tribes were the first inhabitants of the earth, and of all

classes of organized beings, they alone have a title to the name of cosmopolite. The steepest summits of mountains, the widest seas, the most burning sands of the torrid zone, and the perpetual ice of the poles, all supply food to birds, and even to flies. In the deep forests of solitary Finland, it was swallows which gave me notice of an approach to villages. How often have I taken pleasure, in the wide ocean, in observing sea-birds tracing long lines in the air! Their different species pointed me out the approach to land and a change of climate: the gulls, the mews, and the halcyons skimming the waves, announced the coasts of Europe; the puffin was a signal for Cape Finisterre; the white schooners, similar to pigeons, pointed out the approach to shoals; the *sterna fuliginosa*, the open sea; the boobies and frigate birds, the centre of the torrid zone; the black and white winged pintado, the approach to the Cape of Good Hope; the albatross, called, on account of its size, the Cape sheep, indicated the shoals of that tempestuous promontory; while the tropic-birds pointed to the Isle of France, to which, like us, they were directing their course. When, on my homeward passage to Europe, I disembarked on the barren island of Ascension, I saw crowds of boobies and frigate birds arrive there in the evening, returning

from fishing excursions. They perched on various parts of the rocks beside their females seated on their nests, and gave them over the food which they had caught, and which they were seen disgorging from their craws. I took several of them in my hands without causing them any alarm, and I could not help thinking that, had it been my lot to suffer shipwreck on such a shoal, I should have been enabled to form with those birds an association less subject to interruption than that of man. I should have endeavoured to incline their social disposition to friendly services by a mild and attentive conduct on my part. They were, from the first, so easily familiarized to me, that I should have found no difficulty in tying a letter to their wings, and in thus conveying information of my situation to some hospitable people in America or Africa. This method of communication seemed to me infallible with pelicans, which are birds of passage much larger than swans, and found in all parts of the world. They are said to come in summer even to European rivers, and are so easily tamed, that one which I saw at the Cape of Good Hope, although not domesticated, was in the habit of playing with a large dog near the Custom House. Culmanus wrote to Gessner that a tame pelican was in the habit of accom-

panying the Emperor Maximilian in all his excursions, even to the army; and that he lived to the age of eighty. The Chinese fishers and North American savages are said to be in the habit of accustoming these birds to go to fish for them, and to make them bring home their prey in the large crop or pouch suspended by nature from their throat. The flight of the pelican is very long and very high; this bird is said likewise to have the power of taking rest on the water, from the surface of which it raises itself by means of its feet, which are webbed like those of ducks. It is a gloomy and melancholy bird, and seems destined, by its wandering character and the strength of its flight, to be a kind of messenger to navigators. In that capacity it would render more service than the courier-pigeon ever did to the inhabitants of Alexandria. How many navigators have perished on unknown shoals, who might have been enabled to revisit their countrymen, had they had the means of apprizing them of their situation by the flight of birds. Unfortunate La Peyrouse, you and your companions might perhaps have owed to them the preservation of your lives!

Aërial Harmonies of Man and of Children.

MAN exercises on air a power which is found sufficient for all his wants. He forces it to light his fire in a stove; to draw his water from a pump; to grind his corn with the sails of a mill; to send forth musical sounds from a flute; to guide him on the ocean with the sails of a ship, and even to the upper part of the atmosphere in a balloon. He thus makes it his servant, his musician, his slave, and his beast of burden. But the power of man over the elements is a consequence of his social harmonies; and we now proceed to consider him when subordinate to the empire of air, when an infant, naked, and alone, he cries on the bosom of his mother.

The voice and hearing are, by their nature, two twin-senses; for while the other senses have their enjoyments distinct from each other, those have them in community and in reciprocity. Our sense of sight is gratified without any accompanying effect on our sense of smell, of taste, or of touch; nor do the organs of those senses afford any accompanying gratification to the sense of sight; but the voice speaks to the hearing, and the hearing listens to the voice. It is not to preserve connexion with the elements, but to unite two kindred senses, that Nature has given

to each of them an active and a passive power; not by separating and distributing those powers to them like distinct sexes, united only at particular periods, but by combining them in the same individual, that they may be perpetually linked together in double harmony. A being in a state of suffering calls out, and is listened to by a sentient being who returns him an answer, and who is again listened to in his turn. Such is the double chain with which Nature has formed the first of moral harmonies, the fraternal; but as they are all connected with the maternal bosom, we shall proceed to exhibit here the first links of the chain.

I know nothing more affecting than the cries of an infant. I leave it to philosophers to trace the relation between inarticulate, shrill, artless sounds, and the fibres of pity, strung by Nature in the human heart. I shall merely observe that Virgil, so just in all his sentiments, placed at the entrance of the lower regions the little innocents who died at the breast:

Continuo auditæ voces; vagitus et ingens,
Infantumque animæ flentes in limine primo;
Quos dulcis vitæ exsortes et ab ubere raptos
Abstulit atra dies, et funere mersit acerbo.
Hos juxta falso damnati crimine mortis.
Nec vero hæ sine sorte datæ, sine judice, sedes.

ÆN. VI. 426, et seq.

Before the gates, the cries of babes new-born,
Whom Fate had from their tender mothers torn,
Assault his ears: then those whom form of laws
Condemn'd to die, when traitors judg'd their cause.
Nor want they lots, nor judges to review
The wrongful sentence, and award anew.

Warburton alleges that Virgil meant, in his account of Æneas's descent into hell, to pourtray the initiation into the mysteries of Ceres, and that the unhappy condition of infants thus prematurely cut off, and of innocent persons who had fallen by an unjust sentence, was intended to awaken the tenderness of parents, and to inspire horror for unrighteous judgments. The Professors of the University of Paris, who, in 1751, published a translation of the Æneid, inserted in a note this mark of Warburton's erudition; yet I cannot help taking the liberty of saying that I consider it as erroneous. Could it be necessary to exhibit a picture of children and innocent citizens deploring their destiny, to awaken paternal tenderness, or to create indignation at iniquitous decrees? My idea is that Virgil's intention was to excite the sympathy of the reader in the outset of his description of the lower regions. He takes very good care to introduce neither the hero nor his reader into those regions of horror on which the Italian poets, and among

others Dante, ventured in later ages to enter. The Sibyl, we perceive, first leads Æneas into the spot destined to the innocent victims of divine justice, and into that occupied by the victims of human decrees, the poet considering them as approximated by their coincidence in destiny. He places at some distance, and in the interior of the infernal regions, those who had deprived themselves of life, and he imposes on them no other punishment than the pangs of repentance. He thus goes on increasing, step by step, his appeal to our sympathy, and next proceeds to describe the *lugentes campi*, in which he exhibits, wandering amid a forest of myrtles and along solitary roads, those women whose passions had rendered them unfortunate. Here is Phædra, the victim of her love of Hippolitus; the jealous Procris, who perished by the hands of Cephalus, her too-much-beloved husband; Eriphyle, who discovered the concealment of her husband Amphiaraüs, and was punished with death by her son Alcmæon; the too faithful Evadne, the wife of the giant Capaneus, who threw herself in despair on her husband's funeral pile; Pasiphaë, well-known from the fable of the bull; Laodamia, who died of grief on learning the death of her husband Protesilaus; Ceneus, who from a female became a male and invulverable, but was

suffocated under a heap of trees by the Centaurs at the marriage feast of Pirithous; and finally, the ill-fated and silent Dido. After these victims of love, come the victims of war, among whom Æneas sees most of his friends who had perished at the siege of Troy; but when he approaches the infernal prisons, destined to the punishment of the wicked, when their awful gates are opened and roll on their frightful hinges, the Sibyl stops him by the affecting and philosophic verse:

Nulli fas casto sceleratum insistere limen.

After which she proceeds to describe to him, in a plain narrative, this seat of torment into which she had been introduced by Hecate, on being invested with the custody of the forest of Avernus.

Virgil's object was therefore to excite sympathy by stationing young children early cut off, and women unfortunate in love, at the entrance of the lower regions. Let us endeavour to accomplish the same object by stationing both in the present life, if we can, at the entrance of Paradise. No description of beings stand more in need of assistance than a female lately delivered, and a child newly ushered into life.

However great the noise made beside a lately

born child, he does not, during the first six weeks, even turn about his head; for which it is conjectured that his sense of hearing has not yet begun to exist. Of the fact there can be no doubt, but the conclusion appears to me erroneous. If a child be inattentive to noise, it arises from his having had no experience of the causes producing it, and being in no kind of connexion with them. I am persuaded that he hears his own cries, and that he distinguishes his mother's voice in the way that a lamb is seen to distinguish its mother amidst a flock of ewes, and to run towards her without regarding other ewes however loudly they may bleat around it. It is by its cries that an infant demands the breast, of which it has not only a want but a consciousness. Although its name (*infans*) implies an inability to speak, it makes itself distinctly heard in a way that forms the most effectual of all appeals to the heart of a mother. Philosophers may talk till they are tired to a mother on the obligations to suckle a child from the laws of Nature, the love of order, and the love of country. What can they allege, if to these general arguments she gives a pointed answer by particular reasons, and pleads her delicacy, her long watching, her incessant disquietude, the indifference of her country to her wants, and the probable eventual

ingratitude of this youth after attaining the age of manhood? But let her merely hear the plaintive voice of her child, and she will hold it to her breast without any hesitation.

In what manner then does it happen that parents become insensible to the cries of their children, or that they themselves produce those cries by improper and harsh chastisement? The wildest savage would scorn to treat one of his own tribe in this manner; yet even in the present day we see the masters and mistresses of our schools provided with rods and whips. Things have only nominally changed: habits, manners, and characters, appear to continue the same. Let us pass over mercenary masters who govern only by terror, and who see little else than slaves in the children of other persons; but what shall we say of the father who, misled by bad example and false authority, presumes to violate in the case of his son the first sympathetic covenant formed between them by Nature; and who, in so doing, commits a similar trespass towards his fellow-creatures at large?

A mother is the first teacher of a child: let us endeavour to assist her in the beginning of her cares. It is incumbent on her to freshen frequently the atmosphere in which he breathes; for, after warmth, air is his first element and his

first support. Not only ought she to renew the air that he breathes, but to wash his clothes, his cradle, his curtains, and even the room he sleeps in, in order to carry off the mephitic miasmata which are generated in all directions, and which arise from our breathing and our perspiration. It would be superfluous to add that the windows should be open during the day time; an infant without air languishes and loses colour like a plant in a close-room. Nothing, be assured, is so conducive to the strength of children as exposure to the open air, even in winter. During the severe cold in the beginning of 1795, my wife was in the habit of walking at noon, in the sun and in the open air, with our little girl in her arms, then six months old. The child often cried when in a room, from a wish, no doubt, to breathe free air; for as soon as she was taken to it she stopped crying, and afterwards fell into a sweet sleep, the consequence of which was a visible improvement in size and health.

I always remarked that my little girl cried on having her clothes put on, and was delighted to have them taken off. All children are in good humour when their clothes are off, and the little Cupids are accordingly drawn with much propriety in that situation. This cheerfulness proceeds not merely from their being relieved from

the constraint of clothes, for my little daughter never knew what it was to be straitened or confined: it arises, I imagine, from the action of the air penetrating the pores and giving facility to the movement of the fluids. It is well known that perspiration takes place through our pores, and that many of our complaints have their origin in its obstruction. There is perhaps some truth in the notion that the body, in some measure, breathes through the cellular membrane; at least it was under this impression that a distinguished physician recommended air baths as extremely salutary. I attribute the speedy growth of negro children, not merely to the sun's influence on them, but to their being exposed completely to the air by the absence of clothing; the children of the savages of North America are brought up in the same manner, and are equally vigorous. Both, being accustomed like animals to the vicissitudes of the weather, are exempt when they grow up from those colds and rheumatic complaints which are so troublesome to us.

Before seeking to cure the complaints of children, let us see if it is not practicable to prevent them. If our habits do not permit us to let them go quite naked, let us at least accustom boys to live in a keen air with their breasts uncovered. Let us take them, even in the depth of winter,

out of the confined air of school, and give them lessons in an open field; let us take them out to walk on a rising ground. The only precaution necessary is, that they do not get too suddenly cooled after being heated by play. They should be made to pull their clothes over them when they have done playing, and should be kept steadily in motion until they get home; a precaution by which we shall succeed in preventing those pleurisies, defluxions of the chest, colds and rheumatisms, which all arise from obstructed perspiration.

It is practicable to give children an idea of the most profound sciences in the midst of amusing exercise. The fall of their foot-ball will give them a notion of the attraction of the earth, while the curve described by it in the air explains to them the principle of the parabola, composed of the perpendicular movement of weight, and of its horizontal movement of projection. While some are occupied in raising a kite, and wonder at its getting up into the air, explain to them the mechanism of its ascent, and the principle of the decomposition of force; that is of the action of the wind on the inclined plane of the kite. If the weather is favourable you may take an opportunity of exhibiting to them with proper caution a specimen of the wonders of at-

mospheric electricity by means of a kite, the string of which has a brass wire for attracting electric fire, and is terminated by a silk string, which stops the progress of the fire at the hand of him who holds the cord. You may explain to them that atmospheric electricity is solar fire spread around us in an invisible manner; that this fire is communicated to the clouds, and produces thunder only by endeavouring to place itself in equilibrium in all directions. You may add that a distinction is thus to be made between two kinds of electricity, the one being below, the other above the equilibrium in question; that metals, among others iron and copper, serve as conductors; and that it is on account of this property that we put on the top of public buildings iron rods along with iron wires proceeding from them, not to attract the lightning, as is vulgarly imagined, but to withdraw it from the body of the building. An electrical needle has no more the effect of attracting lightning to the roof of a building, than the gutter of the same roof has in attracting rain. In regard to the invisible blow struck on whoever touches the thread of the conductor of an electric kite, I have heard plausible explanations given, but must confess that none of them appeared to me satisfactory or intelligible. I can merely suspect that electric, like every

other kind of fire, contains in itself various properties unknown to us, and among others the principle of motion. I think also that fire of every kind proceeds from the sun, but, like Montagne, I advance these ideas, not as certain, but merely as the result of my reflections; being decidedly of opinion that it is wrong to have any hesitation in confessing our doubts, and even our ignorance.

It is necessary above all, in speaking to children of the general laws of physics, to make a practical application of them to the wants of society. It is always useful to fix their minds on things that interest them, and this can be done only by giving a body and an action to principles. In explaining to them the ascension of the kite by the power of the wind, which decomposing itself on the inclined plane in two directions, the one horizontal, the other oblique, forces it to ascend, you may teach them that the same power produces a circular movement by decomposing itself on the inclined planes of the sails of a windmill. The stream of a deep river would probably produce the same effect on the wings of a water-mill, could they be similarly placed. It is a useful practice to intersperse our lessons occasionally with corollaries; they serve as perspectives in a landscape; they expand and display our powers of compre-

hension. It would be difficult perhaps to find any thing exactly like a windmill, for I recollect no such model in Nature, although perfectly persuaded that it, as well as all the rest of our inventions, may be eventually traced to that source. But this ingenious piece of machinery deserves our particular attention on account of its utility, for it supplies our principal wants throughout the greatest part of Europe, and saves a wonderful deal of fatigue both to men and animals. De Lahire, the celebrated mathematician, never passed a windmill without a strong feeling of respect to the memory of the inventor; yet how many people pass it without bestowing any other thought on it than that of its being a miller's dwelling.

Let us teach children from an early age to estimate men and mechanical arts by a reference to their utility. It is fit to correct them when speaking with slight or indifference to other persons, even to plain workmen. A tone of extreme familiarity becomes the language of pride whenever it is not reciprocal. Besides, children, whatever be their station, ought to behave with respect to grown-up persons. Let us deduce our moral lessons to them from the ordinary occurrences of life, in the same way that we extract information from their sports; it is to morality

that all their knowledge should be made subservient. My object in descanting occasionally on topics of instruction, such as in explaining the necessity of the influence of the sun and the air on the different powers of Nature, is not merely to benefit those who read my book, but the more numerous class of persons who may be connected with them. I do it in the hope that my readers will not plant on their own property trees of which the shade may injure their neighbours' property; I do it in the hope that their conduct will discover more justice than is demanded by the mere letter of the law. I have had the mortification to see, in the meadow of St. Gervais, a rich proprietor forcing successively all his neighbours, by dint of increased plantations, to sell him their gardens and fields, which had been formerly in good cultivation, but were then prevented by the shade of his trees from reaping the benefit of the sun and air.

It is the sun who, by his presence and his absence, produces all the harmonies of the atmosphere, on the waters, on the ground, on vegetables, on animals, and on man. It is probably a reflection of his heat, which the moon sends us in the middle of the night, that modifies the action of the wind. The moon often produces a change of weather by her different phases. Naturalists

are not agreed in explaining the cause of these changes; but I am more disposed to pay attention to the experience of seamen and of cultivators than to imperfect theories. Naturalists maintain that the moon can attract the ocean, and they deny that it can move the atmosphere. These, in my opinion, are two errors which confute each other. I have often, when at sea, seen the moon melt and scatter, at her rising, the clouds suspended in the frozen region of the air, no doubt by the same influence which enables her to melt the polar ice. When you see her surrounded by a yellow border, lay your account with bad weather; her paleness indicates rain; her redness high winds; and the fairness of her countenance is an assurance of settled weather.

Observe the sky overcast in all directions; the sun, concealed behind dark clouds, shows forth long streaks of pale light, the forerunners of a tempest.—The tempest is already risen; flakes of snow fly through the air like the feathers of birds; affrighted herds low in the bottom of valleys; the shepherd, who had been deceived by the hope of a fine day, hastens to assemble them before night. The dreadful south-west wind rises on the horizon, and covers the sky with clouds rolled in mountains like the Alps; in its rapid course, it furrows the surface of the waters, and bends the tops of

the forests, which spread a hoarse murmur around; the trunks of trees are overthrown, and while these monuments of a former age are falling, birds are seen immoveable in the sky. The hawk struggles against the tempest, and sends forth a sullen noise; he spies an unfortunate bird which is destined not to see another spring.

Yet you are not to consider a tempest in the atmosphere, the ravages of forests, or the war of animals, as disorders in Nature; all is combined on an infinitely wise plan. A bird of prey, by destroying the old and infirm of the feathered species, makes room for a new generation. Whirlwinds from the south-west renew the old vegetables, and spread their seeds to a distance; they carry to the frozen regions of the north the warm air of Africa, loaded with the vapours of the Mediterranean; they soften the atmosphere of our zone, while at our northern pole, they accumulate mountains of snow destined to afford at the spring equinox a new supply to the waters of the ocean.

Children, get quickly together your balls and your kites; already your anxious mothers are running out and calling you to your homes. Happy he who inhabits, along with affectionate parents, a humble cottage at the bottom of a valley! Sheltered by an eminence and by his

orchard, he hears without apprehension the roaring of the winds during night. He is lulled asleep by the distant murmur of the forests, and, on closing his eyes, pours out thanksgiving to him who has provided for the wants of all created beings.

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